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Two introductory passages, one regular passage, and one experimental advance organizer passage developed to facilitate initial learning were assigned to normal and retarded children. The subjects were 184 normal 8-year-olds (controls' mean IQ 118.00, organizers' 118.80) and 184 educable mentally retarded 15-year-olds (EMR controls' mean IQ 74.85, organizers' 76.06). No student had a reading level below 3.5 and the means for all groups exceeded 4.0 grade equivalents. All then studied a learning passage and responded to an achievement test which was readministered 2 weeks later. Normal organizer exceeded normal control performances on both immediate and delayed retention measures ($p.05$) but no significant differences between EMR organizer and control groups were found on either retention measure. It was speculated that the EMR-normal differences other than reading achievement and mental age were responsible for the differential utility of the advance organizer. Instructional practice in EMR classes, emphasizing concrete to abstract and specific to general subject matter sequencing, was suggested as antagonistic to advance organizer strategy and possibly responsible for the results. (Author/JD)

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U. S. DEPARTMENT OF
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INFLUENCES OF AN ADVANCE ORGANIZER ON THE VERBAL LEARNING
AND RETENTION OF EDUCABLE MENTAL RETARDATES

(A Comparison of Educable Mentally Retarded and
Intellectually Normal Performances)

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August 31, 1968

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FORWARD

Conducting in situ educational research requires the close cooperation of school boards, administrators, teachers, and, of course, students. The investigators are pleased to thank the Boards of Public Education of Baltimore, Maryland, Newark, Delaware, and Wilmington, Delaware for permission to conduct research within their districts. We extend gratitude for the sincere rather than perfunctory cooperation of the personnel of the schools listed below.

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John T. Neisworth
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Summary

Employing educable mentally retarded and intellectually normal children, the effects of an experimental introductory passage on immediate and delayed retention of subsequent detailed learning material were investigated. The experimental passage, an "advance organizer," was constructed from considerations based on Ausubel's Subsumption Theory of meaningful verbal learning.

Materials consisted of a 200 word advance organizer, a 200 word control (motivational) introduction, a 1200 word detailed learning passage, and a 30 item achievement test. The physical nature of sound was the learning topic. All materials were written below a fourth grade reading difficulty level. Primary studies were conducted to evaluate the adequacy of the materials.

A total of 184 EMR children were randomly assigned to experimental (advance organizer) or control procedures within each of 20 classrooms. After repeated exposure to an introductory passage (advance organizer or control), all Ss studied the learning material and responded to an achievement (immediate retention) test. The test was again administered after 14 days to obtain a measure of delayed retention. The same materials, design, and procedures were employed with 184 intellectually normal children in 11 classrooms. The EMR and normal samples were comparable with respect to reading achievement and mental age.

The hypotheses predicted that the EMR and normal groups that read the advance organizer before studying the learning material would score significantly higher on initial and delayed retention than the respective control groups.

A three factor analysis of variance design with a repeated measure was used to analyze the data. The analysis revealed that the normal experimental (advance organizer) group performance exceeded that of the normal control group on both immediate ($p < .05$) and delayed retention ($p < .05$). No significant differences ($p > .05$) existed between EMR experimental and control groups on either retention measure.

The discussion indicated that:

1. The success of the organizer technique with the normal but not with the EMR sample concurs with previous advance organizer research.

2. Because the investigation employed the same materials with EMR and normal samples, and all groups were of comparable reading ability and mental age, characteristics other than these probably accounted for the differential effectiveness of the advance organizer.
3. A number of environmental or status variables associated with mental retardation may have been responsible for the ineffectiveness of the advance organizer with the EMR subjects.
4. Instructional practice in EMR classrooms typically involves concrete to abstract and specific to general subject matter presentation which is antagonistic to the advance organizer approach. It was suggested, therefore, that the instructional practice with EMR students militates against the advance organizer strategy.

I. Introduction

Statement of Objectives

The objectives of this research were to construct, employ and evaluate the influence of an experimental introductory written passage on the learning and retention of a subsequent learning passage by educable mentally retarded and intellectually normal public school children. The experimental passage, an "advance organizer," was written as an introduction to a more detailed learning passage and was designed according to criteria derived from Subsumption Learning Theory (Ausubel, 1963). Exposure to the advance organizer will, according to the theory, enhance learning and retention of the subsequently presented learning passage; the learning and retention performances of both educable mentally retarded and intellectually normal children were evaluated.

There were several reasons why subsumption theory was chosen as the theoretical foundation for this investigation. First, the theory suggests the advance organizer technique. Other theoretical positions, of course, provide explanations of and strategies for the promotion of verbal learning. Indeed, the advance organizer technique itself could perhaps be derived from other more established and well defined theories, for example, a gestalt position. Subsumption theory, however, directly and explicitly predicted the educational utility of the organizer technique; therefore, the findings of this study must be interpreted in terms of subsumption theory and reflect of its credibility. Second, the theory was chosen because of its specific and exclusive emphasis on meaningful verbal learning. The theory lacks the generality to explain rote or non-verbal learning; it seems, however, appropriate for investigating the kind of learning tasks typical of the classroom, i.e., meaningful verbal learning. Finally, the development and use of advance organizers has obvious relevance to curriculum planning. According to the theory, the arrangement and sequence of knowledge as it exists in a discipline is quite apart from the structure of such knowledge as it exists for the learner. A psychological rather than logical or formal presentation of information is necessary for optimal learning and retention. Further, the optimal presentation of learning material may be a function of the learner's existing cognitive content, cognitive style, degree of retardation, or other such variables. Research with advance organizers is an attempt to increase the present meager knowledge of cognitive structure variables and to discover more efficacious ways of presenting and sequencing large bodies of meaningful information.

Premises of the Study

The following premises emanate from a consideration of the theoretical orientation and empirical research summarized in the subsequent sections of this text:

1. The quantity and quality of information (i.e., cognitive content) an individual possesses in a given subject-matter area is a crucial variable influencing subsequent learning and retention of new information in that area.
2. The educable mentally retarded are at a disadvantage in learning and retaining new information as a function of the lessened quantity and inferior quality of information they bring to a new learning situation.
3. The quantity and quality of a learner's informational repertoire can be altered in order to facilitate learning and retention.

In general, it is presumed that cognitive content and organization can be manipulated in order to enhance learning and retention through the use of programming devices called "advance organizers." A case is presented to support the notion that the educable mentally retarded are in particular need of and can benefit from the advance organizer technique. This technique is an approach suggested by Subsumption Theory.

Research Questions

1. Does Subsumption Theory have the necessary clarity and explicitness of criteria to permit the unequivocal construction of advance organizers? If specifications for organizers are not presently made explicit within the theory, can adequate criteria be derived from the theory?
2. Will the use of a specially prepared advance organizer result in
 - a. a statistically significant greater initial retention mean for the educable mentally retarded (EMR) experimental group when compared with the EMR control group?
 - b. a statistically significant greater delayed retention mean for the EMR experimental group when compared with the EMR control group?

- c. a statistically significant greater initial retention mean for the intellectually normal (normal) experimental group when compared with the normal control group?
- d. a statistically significant greater delayed retention mean for the normal experimental group when compared with the normal control group?
- e. a statistically significant differential effect of the treatment in promoting retention with the normal as compared with the EMR experimental groups?

The Subsumption Theory of Learning and Retention

Subsumption Theory uses the hypothetical construct of cognitive structure as a mechanism for explaining meaningful verbal learning and retention. The particular model of cognitive organization that the theory proposes is characterized by conceptual traces¹ hierarchially arranged in descending order of inclusiveness, generality and abstraction. In the general sense, cognitive structure refers to the hierarchial arrangements of ideas inclusive of all areas of learning and embodying all subjects; however, "cognitive structure" may be used in reference to a specific subject area. As far as teaching method or general educational practice is concerned, it is more useful to view cognitive structure as being differentiated with respect to a particular subject matter. The basic organizational principle of cognitive structure, then, is progressive differentiation of conceptual traces from systems of greater to lesser inclusiveness. Less inclusive systems are linked to higher order systems through the process of subsumption. That is, less general ideas are "subsumed" under more inclusive ideas higher in the structure.

Cognitive structure may be seen, therefore, as an informational framework that makes possible the reception of new material and the emergence of new meaning. Meaningful learning takes place when new propositions are related to (subsumed under) existing systems in cognitive structure. Consequently, the characteristics of one's cognitive structure constitute the chief variables influencing new meaningful learning and retention.

Relevant Cognitive Structure Characteristics

Initial Learning

The availability of relevant subsuming concepts constitutes the

¹Within the context of Subsumption Theory, "traces" refers to a residual of initial learning and NOT to any speculative neurological entity.

chief variable influencing the initial learning and subsequent retention of new material. If meaningful learning of new material is to take place, there must be available in cognitive structure information and ideas that act to subsume or include the new material. This is pre-requisite to the apprehension of meaning.

A second characteristic of cognitive structure that is critical to meaningful learning and retention is the degree to which concepts existing in cognitive structure are discriminable from concepts imbedded in the new learning material. If the learner cannot clearly distinguish new concepts from those he already possesses, he would fail to perceive the uniqueness of the new material.

The third variable of importance is the stability of subsumers used in initial learning. If unstable or ambiguous concepts are used in initial learning, not only will acquisition of new material be difficult, but retention will be jeopardized. Practice or repetition can act to increase stability or clarity of appropriate subsumers.

Retention

Two main areas of investigation in retention are: (1) initial learning and the formation of traces that evoke recall, and (2) the fate of such traces over time, i.e., maintaining the availability of initial learning.

According to subsumption theory, retention is primarily a function of two phenomena. One of these is the quality of initial learning, i.e., the formation of traces (availability, discriminability, and stability of subsumers). The other is obliterative subsumption which is a process that reduces the availability of initial learning through time.

Obliterative subsumption is a later phase of the same interactional process of initial subsumption. During initial learning, material interacts with and is subsumed under appropriate conceptual systems. Continued interaction of new material with its subsumer results in a loss of dissociability. That is, there is a trend in cognitive organization to amalgamate individual entries into the most common conceptual denominator. Information that elaborates or is supportive of an established concept will be irretrievable as a separate identity after time has elapsed. ". . . we are able to remember the general structure of things when their more particular content is no longer available [Kohler, 1947, p. 166]."

One may counteract this later phase of subsumption, i.e., obliterative subsumption, by increasing the dissociability strength of a proposition from its subsumer. This is accomplished through practice,

repetition, the use of exemplars, or multi-contextual exposure, i.e., "overlearning" of the proposition. Thus, the very characteristics and processes that account for optimal initial learning are also responsible for "meaningful forgetting."

The Advance Organizer Technique

Programming Guidelines

The theoretical variables of cognitive structure discussed in the preceding section suggest guidelines for the content and sequence of learning material. Unfortunately, the theory does not make explicit the criteria for an acceptable advance organizer; consequently, an attempt was made to derive from the postulations of the theory a number of guidelines for the development of advance organizers. Each cognitive variable then is translated into a specification for an advance organizer.

Listed and discussed below are the criteria that were developed for use in constructing the advance organizer used in this study.

1. Progressive Differentiation: the concepts embodied in the organizing passage should be sequenced in descending order of generality.
2. Proximity: the initial concepts should be familiar to the learner and thus take advantage of information already possessed.
3. Substantive Relevancy: the organizer should function as an overview of the content of the learning passage it introduces.
4. Integrative Reconciliation: the organizer should make explicit comparisons and contrasts between concepts embodied in the material to be learned and similar (potentially confusing) concepts that may already exist in the learner's cognitive structure.
5. Inclusiveness: the organizer should contain concepts around which much of the information in the learning passage can be organized. Accordingly, the central function of the organizing passage should be that of providing generalizations that are useful in understanding the subsequently presented learning material.

Types of Organizers

Using these programming principles, specially prepared introductory materials may be written that precede the learning task and that attempt to manipulate cognitive structure in order to optimize the reception of new learning. Introductory passages written according to these specifications are termed "organizers" and are of two basic types: expository and comparative.

Expository organizers are written to provide the most relevant ideational framework to subsume subsequent unfamiliar learning material.

If learning material can be assumed to be related to concepts already existing in the learner's cognitive structure, the principle of integrative reconciliation should be emphasized. A comparative organizer may be written to fulfill these functions. This type of organizer explicitly points out the ways in which previously learned and related ideas are similar to or different from new ones.

Background of the Problem

Studies indicate that special class placement of mentally retarded children is no more efficacious than regular class placement (Blatt, 1958; Cassidy & Stanton, 1959; Thurstone, 1960). The findings of a recent and relatively well controlled study by Goldstein, Moss and Jordan (1965) generally corroborate this position. Commenting on this recent study, Blackman and Heintz (1966) stated:

. . . this methodologically sophisticated study of the efficacy of special classes for mentally retarded children blends into the long line of negative findings which have characterized this area of research for the past 30 years [p. 12] .

Johnson (1962) asserted that not only do children enrolled in special classes demonstrate little or no superiority in personal and social development, but they typically exhibit significantly inferior achievement.

Since it is not reasonable to expect theoretical or practical differences between treatments which do not differ, attention has turned toward examining the nature of special class activities, particularly instruction. In this connection, Simches and Bohn (1963) concluded that present instructional programs for educable and normal children do not significantly differ. Sparks and Blackman (1965) have concurred with this observation and have drawn attention to the lack of empirical evidence suggesting that differences actually

exist between regular and special class teaching techniques. Unfortunately, as Quay (1963) has contended, current teaching methodology seems to be founded more on speculation and subjective experience than on research. There is, then, a current and particular urgency for the development of instructional techniques for the retarded which are more promising than those now in use.

A few investigators have responded to the need. Benoit (1957) and Fitzgibbon (1965), for example, have attempted to develop instructional techniques for the retarded based on psychological theory and research. Generally, however, special educators have found psychological theory and research to be of little value in developing specific techniques for the instruction of the retarded.

Stevenson and Zigler (1961) have stated that the psychological literature is replete with studies comparing the learning abilities of normals and retardates within the rather restricted range of paired-associate, discrimination, and serial learning. They have further suggested that there has been little investigation of areas such as complex learning, higher mental processes, classroom learning, and problem solving in social situations. Educators have found it difficult and dangerous to generalize findings derived from contrived laboratory studies of non-verbal and rote learning and retention to classroom meaningful verbal learning.

Blackman and Heintz (1966) expressed this concern when they stated:

. . . special educators typically despair of the educational "applicability value" of much of this work, which often stems more from the investigator's desire to test the tenability of psychological theory than from the practical problems of educating retarded children [p. 16].

Michael (1964) suggested the possibility that the existing gap between classroom practice and psychological research may grow even wider unless comprehensive theoretical formulations concerning practical classroom instruction give research efforts a new direction. One such promising theoretical formulation is "Subsumption Learning Theory" (Ausubel, 1963).

Suggested Relevance of the Organizer Technique in Promoting Learning with Educable Mentally Retarded Children

Studies Using the Organizer Technique

Ausubel (1960), Ausubel & Fitzgerald (1961, 1962), Ausubel & Youssef (1963), Fitzgerald & Ausubel (1963) and Dawson (1965) have all

investigated the utility of the organizer method in facilitating meaningful verbal learning and retention. The results of these investigations generally support Ausubel's contention: i.e., subjects exposed to an advance organizer exhibit significantly superior learning and retention. All these studies, however, have employed intellectually normal subjects of high school or college age. Relevant to the present study, however, another finding has emerged: organizers seem to be specially helpful for subjects with low verbal ability and below average background knowledge of the learning topic (Ausubel & Fitzgerald, 1962).

This finding at least suggests the potential applicability of the organizer technique in promoting meaningful learning with young normal and adolescent retarded children. Grotelueschen & Sjogren (1968), using differentially structured introductory and learning materials, have reported the facilitating effect of introductory materials on learning and transfer of subsequent learning materials. They employed as subjects adults of superior intelligence (WAIS scores of 146-161). The previous research of Ausubel & Fitzgerald (1962) found organizers to be differentially effective for persons of low verbal performance. Grotelueschen & Sjogren attributed the apparent discrepancy to the complexity of the learning topic. They have suggested that the benefit of introductory materials is comparable when subjects of high ability are confronted with a complex learning topic and subjects of low ability receive a less complex task.

A study of the organizer technique employing retarded adolescents was conducted by Blackhurst (1966) in which no significant differences were found between the retarded experimental (organizer) group and a control group. Neisworth (1967), in a similar study, also reported negative results and suggested the need for greater definitional clarity of the criteria for organizers. No other studies employing retarded subjects have been reported. Neither Blackhurst nor Neisworth were able to ascertain with certitude whether their failure to find significant differences in favor of the organizer group was due to the inappropriateness of the organizer strategy with retarded children or to the use of defective or inadequate advance organizers. Neisworth recommended the utility of a study involving both retarded and normal subjects of comparable mental and reading age which, by using the same experimental materials for both groups, may help to determine the differential effectiveness of an organizer with retarded vs normal children.

The literature search for the present study failed to locate any advance organizer studies that involve young children, whether retarded or intellectually normal.

Studies of EMR Learning Characteristics
Suggesting the Appropriateness of the
Organizer Technique

This section presents a summary of recent evidence and speculations concerning retardate performance in the following research areas: long-term retention, incidental learning, paired-associate learning, verbal mediation, and concept formation. Some of the findings indirectly suggest the appropriateness of advance organizer techniques with the educable mentally retarded.

Long-Term Retention. Postman (1965) draws attention to the accumulating evidence that differences between normal and EMR performances on retention tests are not necessarily related to learning ability. Several prominent researchers all have suggested that when certain influencing variables are controlled, especially degree of initial learning, the retarded do not seem to exhibit a long-term retention deficit (Pryer, 1960; Johnson & Blake, 1960; Ellis, Pryer & Barnett, 1960; Lott, 1958). Indeed, Bugelski (1963) asserted that there are no such things as poor memories, just poor learners. Lipman (1963) agreed with this position and suggested that learning inadequacy depends upon temporal relations in the learning task and upon the meaningfulness or familiarity of the material.

The previously assumed relationship between ability to learn and capacity to retain is, therefore, no longer tenable. What appear as differences in retention between fast and slow learners can now be attributed to differences in initial degree of learning. When degree of learning is held constant or is in other ways equated, there is no predictable relationship between learning ability and retention. There is, then, no compelling evidence to support the notion of a long-term retention deficit in the retarded. The evidence instead points to a theory which relies on acquisition inadequacies to explain apparent retention weaknesses. This position is consonant with Ausubel's view that the nature of initial learning (availability of subsumers of varying relevance, discriminability, stability and clarity) is the principle factor in determining retention. It can be speculated that the educable exhibits "acquisition inadequacies" (and thus a retention deficit) because of a paucity, indiscriminability, or instability of subsumers in his cognitive structure.

In agreement with the trend of research findings, Denny (1964) stated that apparent retention deficits are attributable to deficits in learning. He postulated that retardates exhibit acquisition inadequacies because they are poor "incidental learners." They cannot, unlike the good incidental learner, bring the same wealth of

information to each new learning situation. To remediate current learning and retention deficits, Denny recommended "building-in" what the retardate has failed to learn incidentally during early years through the use of specially designed and programmed teaching devices. The promise of organizers for accomplishing this function is self-evident: organizers are deliberately designed to "build into" cognitive structure those relevant concepts that will serve as anchoring foci for new learning, intentional or incidental.

Verbal Learning. In the area of paired-associate learning and verbal mediation, Bugelski (1963) stressed the point that subjects usually seek "bridges" or "links" between a pair of words to aid in acquisition and retention. Words or ideas used to perform this function are usually termed "mediators." Subjects do not always have the most effective mediator available, however; often subjects will try a number of "links" before hitting on the one that effects satisfactory associate-learning. The consensus among researchers seems to be that retardates, when compared with normals, either never find or are slow to find verbal mediators (Lipman, 1963). We must examine, however, the nature of the materials employed in many verbal mediations studies. Often the material to be learned is unfamiliar to the subject. Kohler (1947) discussed familiar, unfamiliar, meaningful and rote materials and advanced the notion that "... association occurs spontaneously where organization is spontaneous [implying meaningful or familiar content] and that association presupposes intentional combining [seeking of associates] where the material as such is unlikely to form organized groups [i.e., unfamiliar or rote material] [p. 156]." It appears that the seeking of associates is a different process than making associations per se. Lott (1958), for example, found that educables, when matched with equal CA normals, showed no inferiority when the materials to be associated were highly familiar. It should be pointed out that Lott used pictures rather than words as stimuli. Since some recent studies indicate that the kinds of associations elicited by pictures and words differ, it would be unwise to generalize to verbal mediation on the basis of studies using non-verbal materials (Bourisseau, Davis & Yamamoto, 1965). Nevertheless, a number of studies that have used verbal materials reveal the same importance of familiarity. Underwood and Schulz (1960) concluded that speed of learning (on paired-associate, serial learning and similar tasks) is greatly accelerated when test stimuli and responses are meaningful. Eisman (1958) stated that educables seem to develop new associations of already well-differentiated stimuli and responses as quickly as chronological age peers of normal or even superior intelligence. Similarly, Postman (1965) observed that responses which conform to the subject's pre-existing verbal habits are rapidly acquired.

Findings from studies of abstraction and concept formation also suggest the utility of advance organizer techniques. Research on the role of verbal mediators in the formation of concepts demonstrates that educables have trouble developing abstractions unless specific verbal mediators are made available to them (Griffith & Spitz, 1958; O'Connor & Hermelin, 1959; Berkson & Cantor, 1960; Griffith, Spitz & Lipman, 1959). Berkson and Cantor stated that even the moderately retarded benefit from mediational training in concept formation tasks and that the amount of benefit is not necessarily related to I. Q. level. Similarly, O'Connor and Hermelin indicated that meaningful mediators can be established and expected to endure. They found, however, that meaningful associations are effected only when meaningful associates are made available to the subjects.

"Meaningful associates" may be viewed as specific subsumers capable of relating two or more words or symbols to a common idea and thereby imposing meaning on an otherwise arbitrary relationship.

Still dealing with abstraction, Bernstein (1960) pointed out that retardates may have trouble in abstraction because of their dependence on "public language" as opposed to "formal language." While public language uses and thus confines the user to a concrete and descriptive level of conceptual operation, formal language

. . . facilitates the verbal elaboration of subjective intent, sensitivity to implications of separateness, and differences, and points to the possibilities in a complex conceptual hierarchy for the organization of experience [Bernstein, 1960, p. 271] .

This position is consonant with the preceding ones; namely, that educables may not have the language structure, verbal mediators, or familiarity with a variety of materials and ideas to engage in efficient verbal learning.

The research cited in this section has emphasized as responsible for inferior EMR verbal learning the following deficits: (a) poor incidental learning, (b) lack or paucity of verbal mediators, (c) unfamiliarity with and a consequent non-meaningful or rote approach to new learning, and (d) lack of the formal language crucial to verbal elaboration and precision of ideas. Although each of these deficits may be separately employed as an explanation for inadequate verbal learning, they can be unified within the framework of subsumption theory. Applying the theory to explain these several deficits, it can be postulated that the educable mentally retarded exhibit verbal learning and retention inadequacies because of certain undesirable characteristics of cognitive structure: namely, marked deficiencies in the availability, discriminability or stability of subsumers.

Theoretically, advance organizers can remove or reduce cognitive deficits. Although it is not within the scope of this investigation to test each of the following propositions, theoretically, advance organizers should:

1. Compensate for poor prior individual learning by intentionally introducing into cognitive structure those concepts usually possessed by the non-retarded child. Subsequent incidental learning will then be facilitated.
2. Make verbal mediators available by providing the subsuming "links" or "bridges" necessary for association and abstraction.
3. Establish and increase the familiarity and meaningfulness of new material by relating it to previous understandings through the use of the programming principle of integrative reconciliation.
4. Incorporate and arrange the "formal language" required for verbal precision, elaboration, and discrimination. The principle of progressive differentiation may be used to arrange information while integrative reconciliation should be used to explicitly point out similarities and differences among concepts.
5. Optimize and establish initial learning by incorporating into cognitive structure appropriate subsuming concepts.
6. Reduce the forgetting due to unconsolidated initial learning.

Subsumption learning theory seems to provide a tenable theoretical explanation for educable verbal learning and retention deficits as well as the advance organizer instructional technique for the remediation of such difficulties.

Variables and Research Hypotheses

Independent Variables

Nature of the introductory passage: advance organizer (experimental) vs non-organizer (control) introductory passage.

Dependent Variables

- a) Learning, as defined by scores on a thirty item achievement test.
- b) Retention, as defined by scores on a repeated administration of the learning achievement test with fourteen days between testings.

Status (Organic) Variables

For purposes of this investigation:

- a) Educable Mental Retardation, as defined by placement in a public school special class for EMR (all such children usually score between fifty to eighty on the, e.g., Stanford-Binet Intelligence Test).
- b) Intellectual Normalcy, as defined by placement in a regular public school class (all such children usually score above eighty on, e.g., The Stanford-Binet Intelligence Test).

Hypotheses

The following hypotheses emanate from the foregoing theoretical considerations and review of the empirical research.

1. The EMR experimental (organizer) group mean, when compared with the EMR control group mean, will be significantly higher on
 - a. learning, and
 - b. retention.
2. The normal experimental (organizer) group mean, when compared with the normal control group mean, will be significantly higher on
 - a. learning, and
 - b. retention.
3. The organizer influence on combined learning and retention means will not be significantly differentially effective for the EMR as compared with the normal group performances.

II. Research Procedures

Presented in this section are descriptions of (a) the general experimental design, (b) the materials, and preliminary evaluations of the materials, (c) the procedures, and (d) subjects for the main investigation, and (e) the intended analysis.

The General Experimental Design

Qualified students within each classroom involved in the study were randomly assigned to an experimental or a control group. The experimental groups read a specially prepared "advance organizer" introductory passage (Days 1-4) while control groups read a control introductory passage. On Days 3 and 4, all Ss also studied a detailed learning passage. On Day 4, all Ss responded to an achievement test based on the learning passage. The same test was re-administered two weeks later (Day 18).

Table 1 summarizes the general experimental design.¹

Table 1

General Design and Treatment Schedule For the Main Investigation

Group	Day 1,2	Day 3	Day 4	Day 18
EMR Class 1...20	R O	O, L	O,L,T	T
	R C	C, L	C,L,T	T
Normal Class 1...11	R O	O, L	O,L,T	T
	R C	C, L	C,L,T	T

Where:

R - random assignment of Ss to organizer (O) or control (C) procedures within each classroom

O - exposure to advance organizer

C - exposure to control introductory passage

L - presentation of detailed learning material; used in evaluating initial (Day 4) and delayed (Day 18) retention

Class 1...n - number of classroom units involved in the study.

¹The design is an adaptation of the Stanley and Campbell post-test-only Control Group Design N.L. Gage (ed.) Handbook of Research on Teaching. (Chicago: Rand-McNally & Co., 1963), pp. 195-197.

The Materials

The investigation employed four specially prepared instruments: (a) a learning passage, (b) an advance organizer introductory passage, (c) a control introductory passage and (d) an achievement test (the dependent variable). A description of each of these instruments follows.¹

The Learning Passage²

The learning material for this study consisted of a specially prepared 1,200 word passage dealing with sound.³ Emphasis was placed on the scientific explanation and production of sound using real life examples. The content included the properties of matter, generation of sound, properties of sound, physiology of the ear and its relation to sound, and examples of objects that produce sound.

The topic of sound was thought to be appropriate for several reasons:

1. The topic was anticipated to be relatively unfamiliar to students.⁴ It was important to meet the criterion of unfamiliarity for two reasons:
 - a. The advance organizer was designed to facilitate subsumption of the learning passage; therefore, it was important that students not already possess optimal subsumers. Such a situation would have contaminated the potential influence of the organizer.
 - b. The use of unfamiliar material assumed that all students would begin from the same baseline in learning the material.
2. Secondly, the topic of sound was thought to be appropriate since a written passage dealing with the action and treatment of poisons has potential meaning. Such a passage has ideas and information that can be organized, as opposed to arbitrary, conceptually unrelated material.

¹All materials were written at or below the fourth grade reading level; see pp. 19.

²See Appendix A.

³The content for the learning passage was based on sections dealing with sound and acoustics from various general science books.

⁴An informal survey of the participating schools indicated that the content of the learning passage had not been formally presented in any of the classes.

3. Finally, the topic was chosen because it was scheduled as part of the future general science curriculum.

The Advance Organizer¹

The advance organizer employed in this study was written following the general recommendations outlined by Ausubel (1963). Briefly, a two hundred (200) word treatment passage presented each student with an overview of the learning passage in advance of his exposure to that passage. In addition, the treatment theoretically provided the organizing concepts that could most directly and relevantly subsume the particular and specific content of the learning passage; at the same time, the organizing concepts were related to the students' presumed cognitive content, i.e., to understandings already familiar to the student. It would, of course, be time consuming and difficult to write individual organizers. To avoid this problem, the organizer began with and related to concepts thought to be familiar to all students. This represents an application of the principle of integrative reconciliation.

To provide the organizing concepts referred to above, the organizer used a hierarchical series of verbally and pictorially expressed concepts presented in descending order of inclusiveness and abstractness; that is, the passage was written according to the principle of progressive differentiation. Thus, the most inclusive and general aspects of sound were presented first; progressively, the passage became more differentiated and employed less inclusive information. Even at this lowest level of generality, however, the organizer did not, of course, include details of the learning passage. Accordingly, for example, the treatment passage began with the properties of matter and progressed to a discussion of the generation of sound. Diagrams and examples of sound-producing bodies were employed.

The Control Introductory Passage²

A two hundred (200) word control passage contained material dealing with examples of sounds the subjects might encounter in everyday life. This passage was judged to provide no advance conceptual organization and, therefore, was hypothesized not to effect subsumption of the subsequent learning material. The control passage, in fact, resembled the usual textbook chapter introductions written to motivate the student to learn.

¹See Appendix B

²See Appendix C

The Achievement Test¹

The criterion test designed for this study was an objective type test which consisted of concept comparison and multiple choice (four option) items and one long answer item. The long answer item was scored objectively against a pre-determined criterion list. The 30 items included in the final test were chosen from a 50-item pool utilizing an item analysis procedure. The average difficulty index of the items was .41.²

Preliminary Evaluations of the Materials

Reading Level Estimates

All materials employed in the study were designed to be at or below a reading difficulty level of 4.0 grade equivalents. This low level of reading difficulty was necessary to insure that most of the Ss would be able to read the materials.³ Several vocabulary guides were used in writing the passages (Klare, 1963; Lorge, 1959). All materials were presented to a staff member of the Reading Study Center of the University of Delaware for estimates of reading difficulty. Table 2 displays the estimates for each of the materials involved in the investigation.

Table 2

Reading-Level Estimates for Written Materials Involved in the Study

	MATERIALS			
	Advance Organizer	Control Passage	Learning Passage	Achievement Test
Readability ^a Index	3.6	3.5	4.0	3.8

^aComputed by the Lorge Formula and expressed in grade level units.

¹See Appendix D

²EMR students (N = 23) from a school district not included in the main investigation read the learning passage (time limit 1 hour) and responded to a 50 item achievement test to provide data for the item analyses.

³As reported on p.23, no student had a reading level of below 3.5 and the means for all groups exceeded 4.0 grade equivalents.

Empirical Study of the Unfamiliarity of the
Learning Passage and the Neutrality of the
Two Introductory Passages¹

Preliminary to the main investigation, studies were conducted to estimate the familiarity of the content of the learning passage and the "neutrality" of the two introductory passages. "Neutrality" here referred to the influence of the advance organizer or the control introduction on achievement test performance independent of exposure to the learning passage.

The organizer was designed to provide the learner with a structure to interact with and facilitate mastery of the learning passage. It was methodologically crucial, therefore, to empirically demonstrate that reading the organizer alone did not provide specific help in responding to the learning passage achievement test.

Familiarity was estimated by comparing the actual scores of Ss who took the achievement test (without reading the learning passage) with the chance score on the test. Neutrality was evaluated by comparing the test scores of Ss exposed to only the organizer with scores of Ss exposed to only the control introduction. These scores were also compared with the expected chance score. The results of this pilot study confirmed the general unfamiliarity and, most importantly, the neutrality of the advance organizer. Specifically, the achievement test score mean for students who did not read the learning material did not significantly differ from chance; this supported the assumption that the material was generally unfamiliar. Similarly, test score means of Ss exposed to only the advance organizer or the control introduction were not significantly different from chance; this finding verified the neutrality of the introductory passages. It was therefore assumed that the materials were ready for use in the main investigation.

Treatment and Control Procedures

A split-plot technique was employed so that each classroom contained an experimental (organizer) and a control group. Students were randomly assigned to organizer or control procedures. Factors that might jeopardize the internal validity of the study, e.g., differential teacher behaviors, room conditions, time of day, etc., were therefore obviated. A total of 31 teachers in 9 different schools administered all the materials cited in this section. The investigators

¹For details see Appendix E.

did not intrude into the usual classroom routine. Furthermore, to enhance generalizability of the findings, all teachers were asked to carry out the procedures with as little variance from their usual classroom practice as possible. A total of twenty special class teachers in six Baltimore, Maryland schools and eleven regular class teachers in three Newark, Delaware schools cooperated. Detailed instructions, including a number of precautions, were given to all participating teachers.¹

Specifically, students were randomly assigned to treatment and control groups within each of the twenty EMR classrooms involved in this study. Similar assignment was made within the nine classrooms of intellectually normal subjects. Treatment consisted of having each experimental subject read a two hundred word passage theoretically designed to provide ideational anchorage (subsumption) of a twelve hundred (1200) word detailed learning passage that followed. Twenty minutes were permitted for reading and studying the advance organizer (Day 1). Simultaneous with the presentation of the advance organizer to the treatment Ss, the control group (that is, the other half of the students within each classroom) read a two hundred word passage designed only to provide interest in the learning subject. Again, a twenty minute time limit was used. This passage was designed to be devoid of the organizing properties of the treatment passage. These two introductory passages, then, constituted the independent variable.

Day 2 involved a repetition of the procedures described for Day 1; however, only ten minutes were allowed for reading the introductory passages.

On Day 3, Ss were allowed five minutes to read and study the appropriate introductory passage; immediately thereafter, all Ss were allotted forty minutes to study the detailed learning passage.

The procedure for Day 4 involved two phases. First, the procedures described for Day 3 were repeated. By this time, all students had been exposed to the introductory materials four times and to the learning passage twice. Then, on the same day (during the next period or later in Day 4), the achievement test was distributed. A full forty or forty-five minute period was provided for responding to this test. Teachers reviewed the test directions with the students, told all students when to begin, and gave no further assistance. All materials were returned to the investigator during the following week. The teachers reported that no student needed more time to take the test than that allotted; all procedures went smoothly. Scores on this initial testing constituted the measure of initial retention (Test 1). Teachers were asked to refrain from discussing the content of the materials

¹See Appendix F.

with the students and to absolutely avoid informing any student that there would be a re-testing (delayed retention test, Test 2).

On days 16, 17 or 18, the same achievement test was administered to the subjects. Again, a full class period was available for testing. All Ss completed the test within one-half hour. Subjects who were absent on day 16 were given the test on either of the next two days; in this fashion attrition between Tests 1 and 2 was minimized. Scores on this second testing constituted the measure of delayed retention.

Selection and Description of Subjects

The Initial Subject Pool

The City of Baltimore Board of Public Education provided for this investigation approximately 405 potential subjects diagnosed as "educable mentally retarded" and enrolled in special classes. The Newark, Delaware Public Schools made available approximately 265 intellectually normal students enrolled in regular elementary grade classes. Not all available students were selected as subjects, however. Two criteria were employed in excluding subjects from participation in the study. No student was accepted as a subject who did not score at or above 3.5 grade equivalents on a reading test¹ individually administered for this investigation. This minimal reading proficiency was required because of the reading difficulty of the materials in the study. An attempt was made to write all materials below the fourth grade level of reading difficulty.

Secondly, students were excluded from the study if they had chronic absences. Teachers were asked to indicate which students were often absent; this was done to minimize attrition during the study.

Several other factors were responsible for excluding Ss from the final experimental sample for analyses.

First, some students who entered into the study on Day 1 were not present for the four consecutive days required by the treatment schedule. These students were not included in the initial retention testing (Day 4).

Second, not all students who took the initial retention test were available for retesting (Days 16, 17, 18); only those Ss who participated in both tests were included in the final analyses.

¹Gates Paragraph Reading Test

Finally, some scores were randomly dropped to equate all N's in order to simplify the statistical analyses.¹

The Final Experimental Sample

Table 3 summarizes descriptive data for all Ss who participated in both administrations of the test and whose scores, consequently, were entered into the final analyses.

Table 3

Subjects Involved in Initial and Delayed Retention Tests;
Intelligence Test Scores, Reading Achievement Scores,
Chronological Age and Sex Distribution

	EMR		NORMAL	
	Organizer (N = 92)	Control (N = 92)	Organizer (N = 92)	Control (N = 92)
Mean I. Q. ^a	76.06	74.85	118.80	118.00
S. D.	7.99	7.01	15.84	15.04
Range	60-95	61-93	61-146	70-147
Mean Rdg. Ach. ^b	4.92	4.95	4.86	4.80
S. D.	.67	.60	.62	.66
Range	3.6-7.7	3.5-6.2	3.6-6.2	3.5-6.2
Mean CA (months)	184.80	182.64	103.05	101.50
S. D.	15.66	17.84	17.94	17.83
Range	156-235	156-223	96-127	98-227
Males	43	45	46	43
Females	49	47	46	49

^aSlosson Intelligence Test for Children and Adults

^bGates Advanced Primary Reading Test

¹Details of the factors responsible for sample reduction are given in Appendix G.

Scheduled Analyses

1. The score for a subject on the dependent variable (the achievement test) represents the total number of correct responses.
2. Scores for all members of each treatment or control groups on each separate test administration were pooled to arrive at an overall mean for that group. Thus, initial retention scores for all members of all EMR organizer groups were pooled to yield an overall EMR organizer initial retention mean. Accordingly, eight separate means were derived to summarize the performance of the following groups:
 - a. EMR organizer initial retention
 - b. EMR control initial retention
 - c. EMR organizer delayed retention
 - d. EMR control delayed retention
 - e. Normal organizer initial retention
 - f. Normal control initial retention
 - g. Normal organizer delayed retention
 - h. Normal control delayed retention
3. A three-factor analysis of variance design with repeated measures (Winer, 1962) was employed in order to test the hypotheses concerning the influence of the advance organizer on learning and retention within and between the EMR and Normal groups.
4. Both F-tests of interaction effects and the modified q statistic (Newman-Keuls Method) (Winer, 1962) for investigating differences between treatment means were employed.
5. The .05 p level was employed in all analyses as the necessary level for rejection of the null hypothesis.

III. Results

Description of the Statistical Procedures and Findings

The results of the statistical analysis of the performance on the criterion measures are presented in this chapter.

In order to examine inter-group differences as well as interactions among groups, the initial analysis performed was an analysis of variance with repeated measures on one factor (Winer, 1962, pp. 337-349). F tests of interactions (Winer, 1962, p. 344) were then performed to determine:

1. the contributing factors in the significant treatment-retention (AC) interaction, and
2. other predicted significant effects which may have been obscured in the overall analysis.

The Newman Keuls method (the q_r statistic) (Winer, 1962, pp. 80-85) was then used to test the difference between all pairs of means. The mean scores, standard deviations and ranges for the four experimental groups on initial and delayed retention measures are presented in Table 4.

Table 4

Means, Standard Deviations and Ranges
For All Experimental Groups of Subjects

(N = 92 per group)

		Normal		EMR	
		Organizer	Control	Organizer	Control
Initial Retention	Mean	13.41	12.34	13.70	12.97
	S.D.	4.08	3.83	4.55	4.66
	Range	1-24	4-23	2-24	1-23
Delayed Retention	Mean	13.17	12.02	12.62	13.63
	S.D.	3.90	4.27	4.42	3.90
	Range	4-21	4-25	5-24	6-22

The analysis of variance with repeated measures of group means was performed to test the significance of the main effects and all interactions. The results are presented in Table 5.

Table 5

Summary of Analysis of Variance
(2x2x2 with repeated measures on one factor)

Source of Variance	Sum of Squares	df	Mean Square	F
<u>Between Subjects</u>	<u>10,650.27</u>	<u>367</u>		
A: Between Treatments (organizer & control)	80.22	1	80.22	2.78
B: Between Status (normal and EMR)	44.51	1	44.51	1.54
AB: Interaction Treatment x status	37.90	1	37.90	1.32
Subj. w. groups error (between)	10,487.64	364	28.81	
<u>Within Subjects</u>	<u>2,524.50</u>	<u>368</u>		
C: Between Tests (Initial Re- tention vs. Delayed Retention)	.84	1	.84	--
AC: Interaction Treatment x tests	31.82	1	31.82	4.74*
BC: Interaction Status x tests	8.06	1	8.06	1.20
ABC: Interaction Treatments x status x tests	37.88	1	37.88	5.64*
C x Subj. w. groups error (within)	2,445.90	364	6.71	

*Significant $F_{.05} - df \ 1, 364 = 3.89$

No significant differences existed for the main effects (i.e., organizer vs. control, normal vs. EMR, initial vs. delayed retention).

However, the interaction between two factors (treatment and retention) was significant ($F = 4.74$, $df = 1, 364$, $F = 3.89$).¹ A profile pattern of this interaction (see Appendix H, Figure 1) showed that

¹The table utilized for the distribution of F (Winer, 1962) could not be entered with the appropriate degrees of freedom. Therefore, the conservative procedure of entering the table at the next lower df level was followed throughout the study.

scores on retention measures are differentially affected by treatment (with normal and EMR scores collapsed). F tests performed on the difference between mean number of correct responses on the two retention measures showed:

1. a statistically significant difference between organizer and control groups on the initial retention measure ($F = 15.88$; $df = 1, 364$; $F_{.01} = 6.75$),
2. no statistically significant difference between organizer and control groups on the delayed retention measure ($F = .82$; $df = 1, 364$; $F_{.05} = 3.89$).

Although no significant overall F was obtained in the treatment-status (AB) interaction or the status-retention (BC) interaction, it was suspected that there were effects which were being obscured; therefore, profiles were constructed and F tests performed to determine if any differences did exist.

The non-significant F obtained for the treatment-status (AB) interaction ($F = 1.32$; $df = 1, 364$; $F_{.05} = 3.89$) showed that scores within normal and EMR groups, collapsed over both retention measures, are not differentially affected by treatment. The profile for this interaction (see Appendix H, Figure 2) revealed a varying effect of different levels of treatment and status. The two F's performed on the effect of treatment on the two levels of status showed:

1. a statistically significant difference between normal organizer and normal control groups ($F = 3.96$; $df = 1, 364$; $F_{.05} = 3.89$),
2. no significant difference between EMR organizer and control groups ($F = .14$; $df = 1, 364$; $F_{.05} = 3.89$).

These results indicate that the overall F for the treatment-status interaction did, indeed, obscure the significant difference in performance within the normal group.

The profile of the status-retention (BC) interaction (see Appendix H, Figure 3) also showed a varying effect (i.e., that of status differentially varying with the retention measure with scores collapsed over treatment). F's resulting from an analysis of status on retention measure revealed:

1. a statistically significant difference between normal and EMR on delayed retention ($F = 6.74$; $df = 1, 364$; $F_{.05} = 3.89$),
2. no significant difference between normal and EMR groups on initial retention ($F = 1.09$; $df = 1, 364$; $F_{.05} = 3.89$).

The treatment-status-retention measure interaction (ABC) was significant ($\bar{r} = 5.64$; $df = 1, 364$; $F_{.05} = 3.89$), indicating that scores obtained for the organizer and control groups interact differentially with initial and delayed retention when status is considered. That is, initial and delayed retention interact with the organizer and control factor differently with respect to normal and EMR groups. With normals, delayed retention scores were (for both organizer and control) consistently lower than initial retention scores. However, within the EMR group, this was not the case; the EMR control group obtained higher scores on the delayed retention measure than on the initial retention measure.

Following these analyses, the Newman-Keuls Method of testing differences between means after an F test was utilized (see Table 6).

Table 6

Tests on Differences Between Ordered Pairs of Means
(Newman-Keuls Method)

Order	1	2	3	4	5	6	7	8
Treatments in order of T_j	f	e	g	d	b	a	h	c
Group	Cont. Norm.	Cont. Norm.	Cont. EMR	Orgn. EMR	Orgn. Norm.	Orgn. Norm.	Cont. EMR	Orgn. EMR
T_j	Test 2**	Test 1*	Test 1*	Test 2**	Test 2**	Test 1*	Test 2**	Test 1*
	1106	1135	1161	1193	1212	1234	1254	1260

*Test 1 - initial retention

**Test 2 - delayed retention

	f	e	g	d	b	a	h	c
f	--	29	55	87	106	128	148	154
e		--	26	58	77	99	119	125
g			--	32	51	73	93	99
d				--	19	41	61	67
b					--	22	42	48
a						--	20	26
h							--	6
c								--

Truncated range r	2	3	4	5	6	7	8
q.95 (r, 364)	2.79	3.34	3.66	3.89	4.07	4.21	4.52
q.95 (r, 364) $\sqrt{NM5}$ error	69.33	83.00	90.95	96.67	101.14	104.62	112.32

Table 6 (con't.)

	f	e	g	i	b	a	h	c
f	--			**	**	**	**	**
e		--				**	**	**
g			--					
d				--				
b					--			
a						--		
h							--	
c								--

It was found in the resulting analysis that

1. the mean difference between normal organizer and control scores (see Table 6) was significantly different on both initial and delayed retention in favor of the organizer in both instances,
2. no significant differences were found between EMR organizer and control groups.

Other differences involving direct comparisons between normal and EMR groups cannot be ascribed to differences in I. Q. level since I. Q. is not an independent variable.

Results Specific to the Research Questions

The following are the research questions proposed in Chapter II with relevant statistical findings from the analyses described in the preceding section.

Research Question 1: Will the use of a specially prepared advance organizer result in a statistically significant greater initial retention mean for the educable mentally retarded (EMR) experimental group when compared with the EMR control group?

Finding 1: No; using the Newman-Keuls test of difference between means, the difference between the EMR organizer and control groups on the initial retention measure failed to reach significance.

Research Question 2: Will the use of a specially prepared advance organizer result in a statistically significant greater delayed retention mean for the EMR experimental group when compared with the EMR control group?

Finding 2: No; the Newman-Keuls test revealed that EMR organizer and control group performances on the delayed retention measure were not significantly different.

Research Question 3: Will the use of a specially prepared advance organizer result in a statistically significant greater initial retention mean for the intellectually normal (normal) experimental group when compared with the normal control group?

Finding 3: Yes; the Newman-Keuls test indicated that the difference between normal organizer and control means on the initial retention measure was significant ($p < .05$) in favor of the organizer group.

Research Question 4: Will the use of a specially prepared advance organizer result in a statistically significant greater delayed retention mean for the normal experimental group when compared with the normal control group?

Finding 4: Yes; using the Newman-Keuls test of differences between means, the difference between normal organizer and normal control groups on the delayed retention measure was significant ($p < .05$) with the normal organizer obtaining the greater delayed retention mean.

Research Question 5: Will the use of a specially prepared advance organizer result in a statistically significant differential effect of the treatment in promoting initial or delayed retention with the normal as compared with the EMR experimental groups?

Finding 5: In the $2 \times 2 \times 2$ analysis of variance with repeated measures on one factor, the treatment *vs.* status (AB) interaction was found to be non-significant ($F = 1.32$; $df = 1, 364$; $F_{.05} = 3.89$) indicating that scores within normal and EMR groups, collapsed over both retention measures, are not differentially affected by treatment. However, in spite of the overall non-significant F for the AB interaction, subsequent F 's performed on the two levels of status revealed a significant difference ($p < .001$) between organizer and control with the normal group only (the mean for the organizer group was significantly greater than

the mean for the control group with normals, but not for EMR's). It should be noted that both status groups were affected in the same way by the treatment factor (i.e., generally, overall organizer performance was greater than control performance); although this general effect is the same for normal and EMR (with the advantage to the organizer groups) only with the normals were the effects significant.

IV. Conclusions and Discussion

General Conclusions

1. With respect to elementary school age intellectually normal children, both immediate and delayed retention of detailed learning material were significantly enhanced by the presentation of an advance organizer. This conclusion agrees with prior advance organizer research employing normal subjects. (Previous reported research, however, has involved older subjects, usually of high school or college age.)
2. With respect to adolescent educable mentally retarded children, an advance organizer was not effective in promoting initial or delayed retention of detailed learning material. This conclusion corroborates the findings of the only two previous organizer studies involving retarded subjects (Blackhurst, 1966; Neisworth, 1967).
3. Although both EMR and normal organizer groups did better on the (collapsed) retention measures than their respective control groups, this was significantly so only for the normals. Ausubel and Fitzgerald (1962) have observed that organizers seem particularly helpful for Ss with relatively poor verbal ability. Nevertheless, the findings of the present study indicate that, with EMR and normal Ss of approximately the same verbal ability (as measured by reading comprehension), the organizer strategy was effective within the normal but not the EMR experimental sample. This suggests that the Ausubel and Fitzgerald observation requires qualification and that variables other than "verbal ability" per se may be involved in influencing the effect of introductory materials.
4. While it is possible that the conclusions cited above may be subject and material-specific, agreement with the research literature lends credibility to the generality of the conclusions.

The EMR Performance: Cautions on Interpretations

Within the Normal sample (as within the separate EMR sample), Ss were randomly assigned to organizer or control treatment. With experimental procedures held constant and subject characteristics equalized through randomization, it is reasonable to attribute any obtained differences (within the limits of chance) to the influence of the treatment. In other words, exposure to organizer vs. control treatment was an independent variable under the control of the experimenter; obtained differences can be attributed, in a causal fashion, to the independent variable.

Because the organizer strategy significantly facilitated initial and delayed retention within the Normal but not the EMR sample, it is tempting to account for the difference on the basis of Normal or Retarded status. Such an explanation, however, would be not only questionable but entirely inappropriate.

It is not possible to interpret normal vs. retarded status in the same fashion as organizer vs. control treatment. Subjects were not, and of course could not, be randomly assigned to a normal or retarded status. Clearly, intellectual status is not under the control of the experimenter; that is, "normal vs. retarded" can in no way be considered an independent variable.

The effectiveness of the organizer with the normal but not with the retarded subjects must be interpreted in a correlative rather than causative fashion. Thus, while it is clear that the differential effectiveness of the organizer was related to the sample employed (EMR or Normal), such differential effectiveness is not thereby explained. While it is certainly true that mean I.Q. is one way in which the EMR and Normal samples differed, it is by no means the only way. For example, the two samples may have differed with respect to socio-economic status, parent educational level, general health, instructional background, learning set, etc. Any one or a combination of these variables, which are often related to retarded status, may have accounted for the failure of the organizer to register a difference between the EMR experimental and control groups.

Speculations Concerning Learning Characteristics of Educables And the Failure of the Advance Organizer

With the cautions of the previous section in mind, it may nevertheless be useful to speculate briefly on some of the variables related to EMR status in an effort to account for the failure of the organizer strategy within the EMR sample.

1. The Advance Organizer was written at a higher level of abstraction than the detailed material it preceded. If EMR Ss cannot at all deal with abstractions, the use of the organizer was inappropriate. It has been suggested that educables are fixed at a concrete level of cognition (e.g., Robinson & Robinson, 1965, p. 357). However, in addition to the rationale presented in Chapter I of this report, there is other evidence that non-retarded persons who characteristically operate at a concrete level of cognition are nevertheless able to deal with first-order abstractions. Inhelder and Piaget (1958) have pointed out, for example, that elementary school children are easily able to work with simple abstractions of ideas about objects and events. Further, studies such as those conducted by Case and Collinson (1966) and Hill (1961) demonstrates that most six to eight-year-old children can easily draw correct inferences from hypothetical premises involving second-order abstractions. The children are able to make correct inferences if they are provided with immediate concrete empirical props. The advance organizer employed in this study did involve concrete props in the form of cartoons and analogies. Although none of the subjects in this study had a "mental age" below that of the average eight-year-old, it might be inappropriate to extrapolate the findings cited above. Therefore, it is possible that the use of the organizer technique, which requires at least first-order abstract operations, is not feasible with the educable mentally retarded.

2. The organizer presented concepts that required transfer and application to the learning task. If educables have difficulty in transfer, the best advance organizer would be of no value if the learner could not apply it to the learning task. Klausmeier and Check (1962) report that "when children of low, average, and high intelligence receive learning tasks graded appropriately to their levels of achievement, they retain and transfer equally well to new situations of appropriate difficulty [p.321].". Other studies have demonstrated that retardates are successful in a variety of transfer of learning tasks. However, these studies are not directly relevant in the present context for at least two reasons. First, the studies involve non-verbal or non-meaningful verbal materials. Secondly, success in the tasks included in these studies required the transfer of identical elements or other particularized transfer. The advance organizer technique, however, involves a kind of non-specific

transfer much akin to the gestalt notion of transposition. In addition to the lack of evidence that educables can cope with this kind of transfer is the expert opinion of those such as Kirk and Johnson (1951) that educables have difficulty in performing the transfer of learning required in the classroom. It is conceivable, then, that the EMR Ss were unable to engage in the kind of transfer requisite to the use of an advance organizer.

3. The structure and content of the advance organizer was generally based on an abstract to concrete, general to specific design. Perhaps the instructional history of the educable children in this study was antithetical to an organizer approach. That is, it is probable that the instruction in EMR classrooms typically involves going from concrete to abstract and specific to general. Therefore, the instructional history of the Ss may have produced a learning set antagonistic to the organizer strategy. It seems reasonable, therefore, to suggest that requiring the EMR Ss to cope with materials whose content and sequence were contrary to those employed in the classroom may account for the ineffectiveness of the organizer approach.

Possible Limitations of the Materials

Since the investigation involved the special preparation of several written passages, especially the introductory materials, the following questions concerning the adequacy of these materials might appropriately be asked. A brief discussion follows the question list.

1. Were all the relevant criteria for an advance organizer derived from the theory?
2. If appropriate criteria for the construction of advance organizers were identified from the theory, did the organizer designed for this study fulfill all these criteria?
3. Is it possible that the control introductory passage also met some specifications for an organizer and thus was not essentially different from the experimental (organizer) passage?

4. How do we know the content of an introductory passage was learned?
5. Did the learning passage itself contain organizing concepts and thus level or obscure the effect of the organizer?
6. Was the achievement test too difficult?
7. Was the time permitted for reading and study of any of the materials excessive to the point of having a leveling effect on the differential influence of the two introductory passages?

Question 1 is, in an absolute sense, unanswerable. There is no way of knowing if all the relevant criteria for an organizer were identified; Subsumption Theory is not explicit on this point. The final criteria developed were derived from a study of Subsumption Theory, Ausubel's (1963) discussion on the general design of organizers, and the several advance organizers employed in previous studies by Ausubel and others (see Chapter I, pp. 9-10).

With respect to Questions 2 through 7, the following singular consideration may be sufficient: apparently the advance organizer, control introduction, learning passage, and achievement test were adequate enough to result in significant differences on initial and delayed retention measures within the Normal sample. The treatment did "work" despite any possible defects in the materials. The problem is that the organizer did not function effectively for the EMR sample. Thus, it would seem that if the materials were defective, they were so only with respect to how they interacted with characteristics of the EMR subjects. Further, the EMR sample characteristics such as reading achievement and mental age probably were not responsible since these were approximately comparable to the Normal sample characteristics. As noted on page 35, there is a strong suggestion that the instructional practice in the EMR classrooms may have militated against the organizer strategy.

APPENDIX A
LEARNING PASSAGE

INSTRUCTIONS

Read these pages to find out about sound. When the teacher tells you, turn the page and learn as much as you can.

You will be given a test about these pages tomorrow or the next day.

Sound and Hearing

Three things are needed to make sound:

1. Sounds are made by anything that moves back and forth. The waves of air that are caused are called vibrations. When something vibrates it makes the air around it move out in waves in all directions. If you hit a fork against a table, the ends will move back and forth very fast. The ends are vibrating and sound waves are made.

(ILLUSTRATED)

2. Something must carry these sound waves. Sound waves can be carried by the air around you. If you are swimming under water, sound waves are carried to your ears by the water. The sound of your own chewing and swallowing is heard because of the bones in your head. Sound travels stronger and quicker through solids and liquids than through gases. Two rocks knocked together under water will sound louder than they would if they were knocked together in the air.

(ILLUSTRATED)

3. The sound waves must get to someone's ears to be heard.

(ILLUSTRATED)

All sounds have pitch. Pitch is the number of motions back and forth made by something in one second. Each complete vibration back and forth is called a cycle. When something vibrates very fast, it makes a high-pitched sound. Such a sound has many cycles in a second. When something vibrates slowly, it has a low-pitched sound and fewer cycles in a second. Sounds can be loud or soft. We find out how loud a sound is by the number of decibels it makes. One decibel is the softest sound you can hear. The sound of breathing is about 10 decibels. Here is a decibel ruler for some sounds:

(ILLUSTRATED)

The loudness or softness of a sound does not have anything to do with the speed of sound. Sound waves travel one mile in five seconds at room temperature (seventy degrees). The speed of sound increases as the room gets warmer by a little more than one foot a second. The speed of sound becomes faster in wet air than in dry air.

Man can make sounds up to thousands of millions of cycles, or vibrations, a second. Man can hear sounds between twenty to twenty thousand cycles. Your ear hears vibrations best at about three thousand cycles per second.

Some animals can hear much higher sounds than people. Bats can hear sounds from fifty thousand to one hundred thousand cycles in a second! By using these sounds bats can turn so they will not fly into things.

High sounds can be used to find submarines under water. This is called sonar. Sonar uses sound to give ships "ears" to hear under water. One type of sonar is used to find out how deep water is under a ship. Another type is used to find fish or submarines under water. These types of sonar send out a sound wave into the water. When the wave meets an object it bounces back. How long it takes for the sound to come back tells you how far away the object is. Sonar uses sound vibrations of five thousand to twenty five thousand cycles a second.

(ILLUSTRATED)

Vibrations that go as high as five hundred million vibrations in a second have many uses. Factories find mistakes in metals and other materials using these sounds.

Do you know how you hear?

Three parts of your body work together to make you hear the sounds that reach your ears. The ear, the auditory nerve, and the brain work together to make you hear.

The outer ear catches sound waves and leads the vibrating air to the eardrum. Sound vibrations that reach the eardrum make it move. It is the job of the middle ear to make these sound vibrations stronger. The little bones of the middle ear change the weak push on the eardrum into a stronger push on the oval window of the inner ear. The push on the oval window is 22 times as big as the push on the eardrum.

(ILLUSTRATED)

The inner ear is made of two parts. The wall between these parts is made of nerve cells. This wall leads to the auditory nerve. The two parts of the inner ear are filled with a liquid. A push on the oval window makes the liquid in the top of the inner ear move. The nerve cells change this push into electric waves. The auditory nerve carries the electric waves to the brain. The brain puts the waves together as the sounds you hear.

(ILLUSTRATED)

Damage to the parts of the outer ear or middle ear can cause a person to stop hearing. People who cannot hear are called deaf. Damage to the parts of the outer ear or middle ear can make you deaf. The outer or middle ear may not be able to carry or conduct sound vibrations to the inner ear.

Never stick anything into your ears. The eardrum can be hurt and does not heal easily when something hard is pushed against it. Only your doctor should remove things that might get into your outer ear.

Sounds are either noisy or musical. Noise is when there are a lot of sounds which do not sound nice together. Noise is made by something vibrating out of order--such as a rattling window. Sudden, loud noises may make people unable to hear. Never make a sharp, loud noise next to anyone's ear. Noise may cause people to become tired or upset, even if it isn't loud.

(ILLUSTRATED)

Scientists have found ways to quiet noise in refrigerators, furnaces, motors and trucks. Quiet spaces are important in hospitals, libraries, schools and homes. Heavy walls that have no cracks or holes in them block noise. Good listening conditions are needed in music rooms, churches, and theaters. The study of acoustics deals with the problem of controlling vibrations that cause sound. Movie houses must be built to bring pleasant sounds to people. Sound must not echo or bounce back off the walls and ceiling. Clear sound must come to the person in less than a second after the sound is made or it will become an echo and not be clear. Builders often cover the inside walls of offices and factories with felt, cork, and other things to soak up sound. Rugs, curtains and furniture soak up sound. A person can absorb about as much sound as does 12 square feet of thick carpet. These things help to control a lot of small bouncing sounds that come together and die away slowly. In a music hall, these sounds should last about two seconds. In a classroom, they should last about one second.

Music is made by something that sends out smooth or even vibrations. Some instruments have strings stretched over some kind of board or resonator. A resonator is the name of any hollow box that resounds or echoes with a sound. Violins and guitars have strings stretched over a box. These strings vibrate after being

(ILLUSTRATED)

pulled and the sound vibrations are caught by the box and made louder. The highness or lowness of the sound that a guitar or violin string makes depends on the length of the string. A person

makes the length of the vibrating part of a string different by pressing his fingers against it.

(ILLUSTRATED)

Some instruments are played by blowing air across the opening of a tube or pipe. This stream of air makes the tube or pipe vibrate. The speed of the vibrations of this air depends on the length of the tube or pipe. People make the air column long or short by closing off openings in the pipe with their fingers.

(ILLUSTRATED)

A whistle works the same way. A whistle makes a sound when air is blown through it. A whistle is made of a tube with a sharp edge called a lip. The air is blown in one end of the tube and swirls around until it hits the lip. This makes the air spread apart and push together again so that it makes a sound. The shorter the tube, the higher the pitch of the sound that is made.

(ILLUSTRATED)

Drums are hit to make them vibrate and make sounds. Musicians also beat metal instruments together such as cymbals to make sounds. You can make different sounds by hitting cans of different sizes with a stick. These are called percussion instruments because percussion means "to strick."

(ILLUSTRATED)

Scientists have studied sound and put it to work. Radios and T.V. help to carry sounds far away. Radio and T.V. use some of these parts:

A microphone changes sound into electricity. This electricity vibrates the same as sound waves vibrate.

A transmitter sends the electrical waves to the radio.

Waves from the loudspeaker in the radio change the electricity back into sound waves.

A telephone also uses electricity to carry sound. It is like the eardrum in your ear. When you talk into the phone the sound waves hit a small metal piece which pull and push the air in front of it. The sound waves are changed into electricity and sent through wires to the receiver of another telephone. Another thing like an eardrum in the second telephone vibrates and sends out sound waves which hit the ear of the person you call.

(ILLUSTRATED)

Scientists have also studied sound and made records which sound as good as music in a music hall. This is called high fidelity. The loud speakers of hi fi sets send out sound waves. These loud speakers are often made of two parts: a woofer (a big speaker) and a tweeter (a tiny speaker). Slow sound waves cause the woofer to vibrate and make low sounds. Fast sound waves make the tweeter vibrate and make high sounds.

(ILLUSTRATED)

Now, you know why people say sound is all around us. Go back, and learn as much as you can so that you can take a test on these pages tomorrow or the next day.

APPENDIX B
ADVANCE ORGANIZER INTRODUCTION

DIRECTIONS

Later this week, you will learn how sound is made. You will learn how we hear sounds and how sounds differ. You will learn how we use sound and how musical instruments, T. V., and radios work.

Today, you will read some pages which will tell you what causes sound. When the teacher tells you, turn the page and read everything. When you read, try to understand everything. Then read the pages over again. This time, try to learn what you missed the first time.

If you have time left after the second reading, go over the pages again and try to really learn them.

PPLEASE DO NOT TAKE NOTES OR WRITE ON THESE PAGES!

SOUND

Do you know what sound is? Sound is anything you can hear. Sound is all around us. When you hear a person talk, or hear a bell ring, or hear music you are hearing a sound.

Do you know what causes sound? Read this lesson to find out what causes sound.

To find out what causes sound you must know about matter. All things are made of matter. You are made of matter. Matter is anything that takes up space. There are three kinds of matter:

1. liquids
2. solids
3. gases

An example of a liquid is water. Liquids flow easily when poured.

(ILLUSTRATED)

Coke, Pepsi, and milk are also liquids.

(ILLUSTRATED)

Ice does not flow easily. It cannot be poured. It is a solid. Wood and rocks are solids.

(ILLUSTRATED)

A solid is hard. It is packed together. It can be picked up easily.

Can you think of a gas? Air is a gas. It is not a solid, or a liquid. It is a gas. We cannot see it. It cannot be poured like water and cannot be picked up like ice.

(ILLUSTRATED)

Your mother uses gas for heating and cooking.

(ILLUSTRATED)

Balloons are sometimes blown up with gas.

(ILLUSTRATED)

All matter is made up of tiny things called molecules. Gases, liquids and solids are made up of molecules. When you squeeze a balloon, you push the gas molecules inside closer together.

(ILLUSTRATED)

You can't see molecules but they are always moving. The molecules of a solid cannot move very fast. Molecules are very close together in anything that is hard or thick. Because these molecules are so close together, they wiggle in the same spot and knock together all the time.

(ILLUSTRATED)

The molecules of a liquid move more quickly and are more spread out than the molecules of a solid.

(ILLUSTRATED)

The molecules of a gas move very fast and are far apart--more far apart than the molecules of a liquid or a solid.

(ILLUSTRATED)

Sounds are made by anything that moves back and forth and causes molecules to shake or knock together. Sounds move quicker through solids than through air, because the molecules of the solid are closer together and knock together more easily. The ground is thicker than air. Sound moves quicker through the ground than through air. This is why Indians used to put their ears to the ground to hear the sounds made by a buffalo far away. If a buffalo were in the air we couldn't hear sounds that he makes because the molecules in the air are too far apart and don't knock together as easily.

Here is another example. If you held your watch to the end of a long stick, your friend could hear it tick by putting his ear at the other end of the stick. He couldn't hear the watch tick if you took the stick away.

(ILLUSTRATED)

Fast shaking molecules make high sounds. Slow shaking molecules make low sounds. Sound cannot go through empty space where there are no molecules.

Here is an example of how sound travels.

(ILLUSTRATED)

When a hammer hits a nail, the hit of the hammer makes the air molecules around the nail go out. The molecules spread apart. When they do this, they push against the next molecules in the air and press them closer together. The molecules then go back and hit other molecules farther away. Sound waves are made when a bunch of molecules hit against each other. As a sound wave gets farther away, it gets weaker. Molecules far away from the thing making a sound are not hit as hard. That is why a sound gets weaker as it travels. Your ear catches the sound waves and changes them so that they are carried by your nerves to the brain.

When fast moving sound waves hit something, they jump back. This is called an echo. If you make a sound in an empty room, the sound waves will seem louder because they hit the wall and come back to you. When a lot of people and furniture are in the room, the music is not as loud. This is because the sound wave is stopped by furniture. An empty room makes the sound seem louder.

(ILLUSTRATED)

Later this week, you will learn more about sound.

Now, go back to the first page and read everything again.

APPENDIX C
CONTROL INTRODUCTION

DIRECTIONS

Later this week, you will learn how sound is made. You will learn how we hear sounds and how sounds differ. You will learn how we use sound and how musical instruments, T.V. and radios work.

When the teacher tells you, turn the page and read everything. When you read, try to understand everything. Then read the pages over again. This time, try to learn what you missed the first time.

If you have time left after the second reading, go over the pages again and try to really learn them.

PLEASE DO NOT TAKE NOTES OR WRITE ON THESE PAGES!

SOUND

You should know about sound because it is all around you all the time. If you sit and close your eyes, you will be able to hear many sounds.

You may hear soft sounds. Paper falling to the floor and people writing make soft sounds.

(ILLUSTRATED)

You may hear loud sounds. An airplane and a rocket make loud sounds. Children shouting make loud sounds.

(ILLUSTRATED)

You should know about sounds because they tell you something. You would not hear the same sounds in a city that you would hear on a farm. In a city you would hear the moving cars, people walking, and many people talking. On a farm you would hear the sounds of barnyard animals, the wind blowing, and bugs.

(ILLUSTRATED)

Sounds help you. A clock tells you what time it is. The ringing of a bell tells you if a fire engine is near.

(ILLUSTRATED)

Sounds also tell you how others feel. The way a baby cries tells you if he is hungry. The way a dog barks tells you if he is afraid.

(ILLUSTRATED)

You need to hear sounds. You will know if there is danger. You will learn what to do. The sounds you hear help you to learn about your world.

Some people make their living using sounds. Some people sing. Some play a horn. Many people play in a band for fun, too.

(ILLUSTRATED)

Some people build special rooms to study sounds. They want to find out how to build better schools. They want to build places for people to come hear music or hear other people talk. These men and women can help you enjoy sounds. These people all work to study sound and bring it to you or keep it away. Scientists have learned

to make better machines to bring sound to you. They can make special records that help you to hear good music. They have learned to make color television sets and better radios. You can use telephones to call people as far away as California or even overseas.

Teachers are interested in sound, too. They want to find out how tired you are when it is very noisy. Some sounds need to be kept away for you to study well.

(ILLUSTRATED)

A doctor can use sounds to find out why you are sick. A doctor can hear your heart beat. He can hear air going in and out of your lungs. If he does not like what he hears, he gives you something to make you well.

(ILLUSTRATED)

Doctors have also learned to help people who cannot hear. Your ears are like bridges that join you to the world of sounds.

Sound must reach your ears to be heard. Your ear has tiny parts which make it work and take care of it. A doctor can test your hearing with a machine to see if you hear well. If you do not hear well, he might be able to help you with a hearing aid. A hearing aid is a small electrical device that picks up sound and makes it louder. More than one and one half million Americans wear hearing aids and another four and one half million need them. Before you or your parents buy a hearing aid, you should visit your doctor and get a hearing test.

The sounds you listen to are the sounds that interest you. When you are playing or when you are watching television, your mother may call you. You may not hear her. She may have to call you many times in a loud voice before you hear her and answer. Your ears did not suddenly stop working. It means that there is more to hearing than just your ears. If you heard all the sounds around you very well, you would hear a jumble of sounds.

(ILLUSTRATED)

Your body has many parts which work together to pick out sounds that interest you. Your ears, your nerves, and your brain all work to help you understand sounds.

What would you do if you could not hear the sounds around you? What would you miss the most?

Later this week, you will learn how sound is made. You will learn how sounds help to make our lives more interesting.

APPENDIX D
ACHIEVEMENT TEST

TEST ON SOUND

Here are some key words to the main ideas you have learned about sound. Read the following 7 sentences below. Fill in the blanks with one of these key words.

acoustics
music
vibrations

eardrum
electric
pitch
sonar

1. A telephone, a microphone, and a loud speaker use these to send and receive sound waves: _____
2. Regular wave patterns which make nice sounds: _____
3. Number of air vibrations each second: _____
4. Submarines use this to find things underwater: _____
5. Fast forward and backward motion of sound waves: _____
6. Sends vibrations to the middle ear: _____
7. The study of controlling noise: _____

Read each of the following. Pick the right answer. Circle the number next to the right answer.

8. Sudden, loud noises and going up in an airplane both affect your ears because they:
 1. Both make noise under 110 decibels
 2. Cause air waves to push hard on the eardrum
 3. Cause the bones in your ear to move too fast.
9. The bones of the middle ear
 1. Change sound waves to electric waves
 2. Lead sound waves to the eardrum
 3. Make sound vibrations stronger.
10. The oval window
 1. Sends vibrations to the middle ear
 2. Makes sound vibrations stronger
 3. Makes liquid of inner ear move.

11. When something vibrates very slowly, it makes a

1. Low pitched sound
2. High pitched sound
3. No sound at all.

12. A transmitter

1. Sends electric waves
2. Changes sound waves into electricity
3. Changes electricity back into sound waves.

13.



A fork vibrating is an example of:

1. Echo
2. Resonance
3. Acoustics.

14. Sound travels:

1. Stronger and quicker through water
2. Stronger and quicker through air
3. Stronger and quicker in a vacuum.

15. The loudness of a sound:

1. Depends upon the pitch of the tone
2. Depends upon the energy of the sound waves
3. Depends upon the number of cycles per second.

16. A short air pipe in a musical instrument will cause a:

1. Low pitch
2. High pitch
3. No pitch at all.

17. The inner ear:

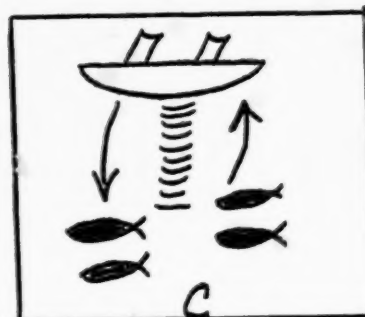
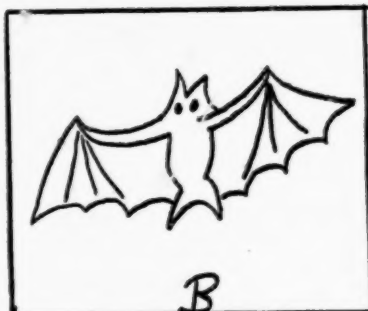
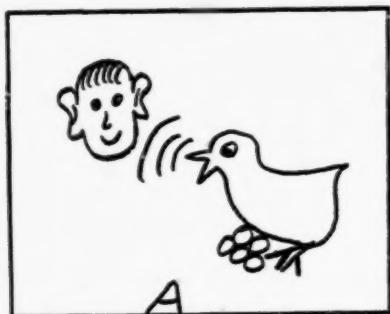
1. Carries electric waves to the brain.
2. Changes sound waves to electric waves
3. Makes sound vibrations stronger.

18. The auditory nerve:

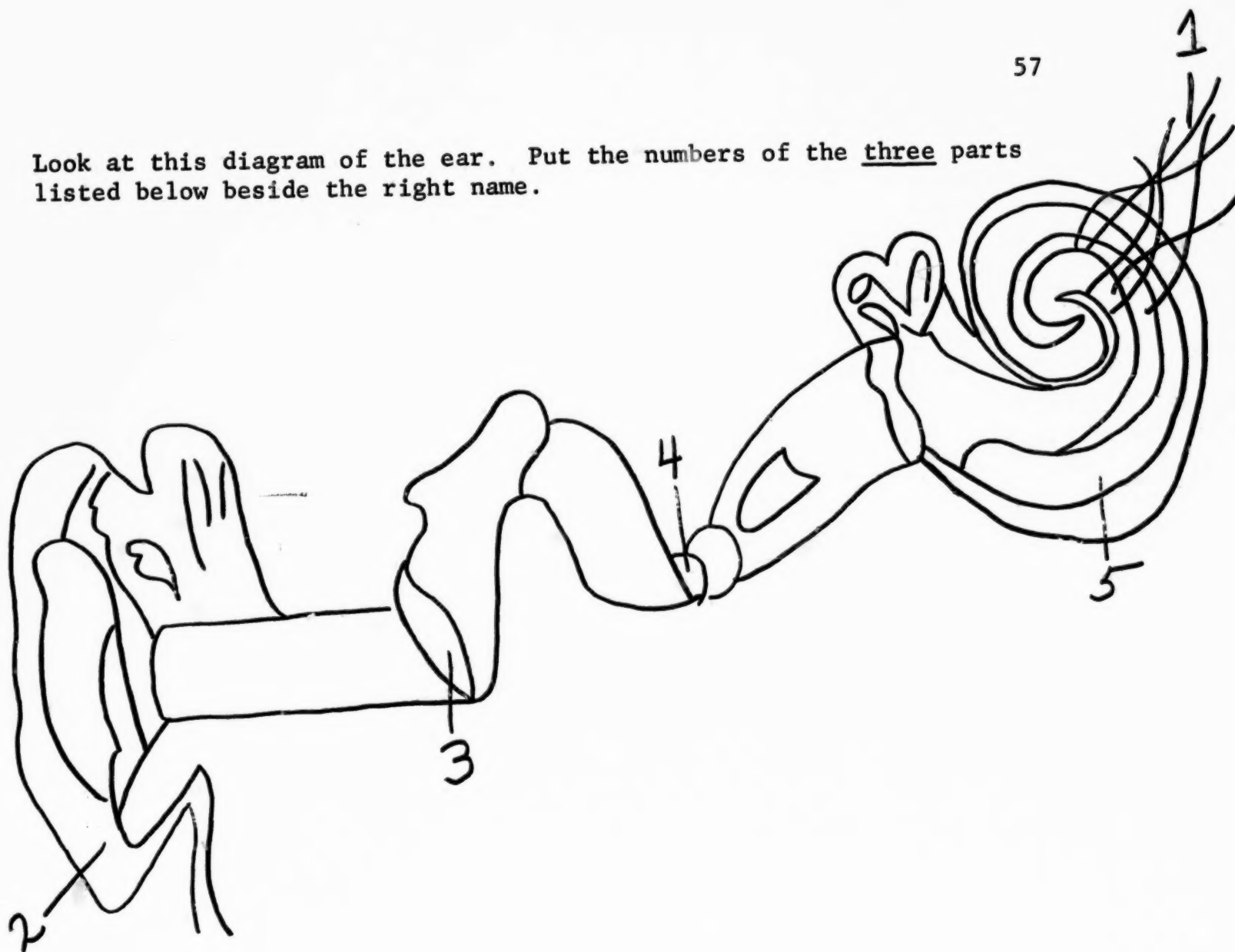
1. Carries electric waves to the brain
2. Makes sound vibrations stronger
3. Puts waves together as sounds.

19. Someone breathing should make a sound of about:

1. 1 decibel
2. 10 decibels
3. 30 decibels.

20. Put a big "X" through the picture which does not belong with the others.

Look at this diagram of the ear. Put the numbers of the three parts listed below beside the right name.

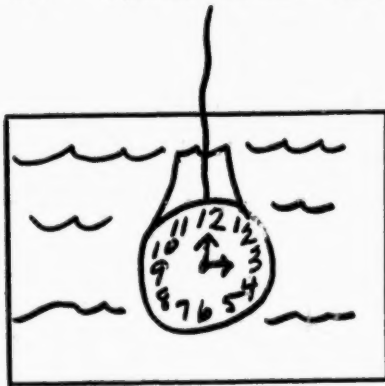


21. _____ the outer ear
 22. _____ eardrum
 23. _____ auditory nerve

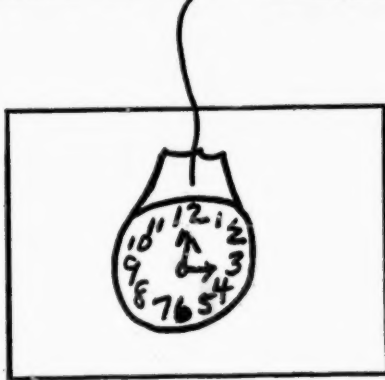
You have learned about Noise and Music. Read each of the following sentences. Decide if they are about Noise or Music. Put an "N" in the blank space if the sentence is about Noise. Put an "M" for Music. Sometimes the sentence is about both Noise (N) and Music (M). Put an N and M if the sentence is about both.

24. When a room is empty, sound waves will be reflected from its walls _____.
 25. Sound waves spread out in all directions from its source _____.
 26. Uneven wave patterns get in each other's way _____.
 27. Sound travels only through matter _____.
 28. Cymbals and percussion instruments vibrate when hit _____

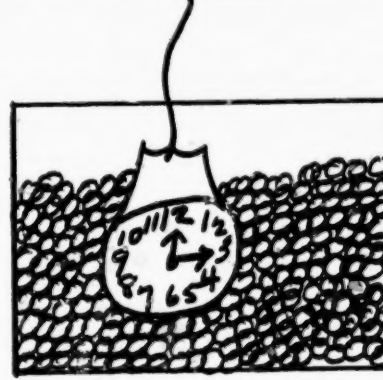
29. Which clock will sound louder? Circle the right letter.



A. WATER

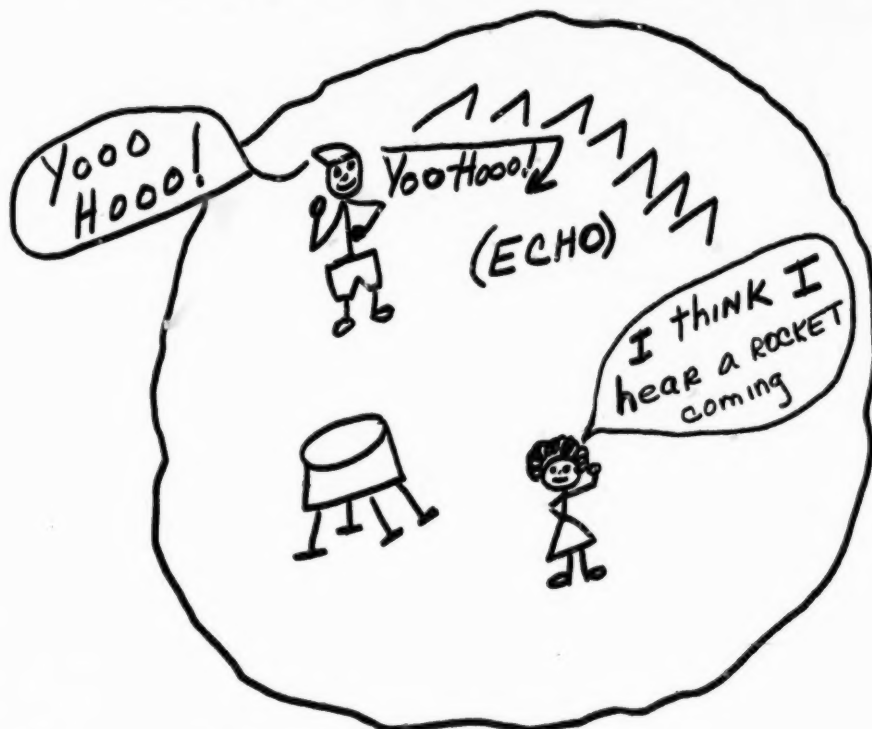


B. AIR



C. COTTON

30. The moon has no air. What is wrong with this picture?



On the Moon

Write your answer here.

APPENDIX E

EMPIRICAL STUDY OF THE UNFAMILIARITY OF THE LEARNING PASSAGE
AND THE NEUTRALITY OF THE TWO INTRODUCTORY PASSAGES

Preliminary to the investigation, studies were conducted to determine the relative "familiarity" of the subjects with the content of the learning passage and the "neutrality" of the two introductory passages. "Familiarity" was determined by comparing the actual scores of students who took the criterion test (without reading the learning passage) with the chance score (7.5) on the test. "Neutrality" was determined by comparing the test scores of subjects exposed to either introductory passage (organizer or control passage) with the chance score and with each other.

Seventy students were randomly selected from EMR classes in the Wilmington, Delaware Public Schools. A class of 41 of these subjects were asked to read the organizer introduction while 29 were asked to read the control introduction.

Both groups were allotted 15 minutes on two consecutive days to read the appropriate introductory passage. On the second day, both groups were given 45 minutes to respond to the 30 item objective test. Neither group was presented with the learning passage. All materials were administered by the student's own teacher in the regular classroom situation. Subjects involved in these control procedures were not also part of the main investigation. Table A summarizes descriptive data on intelligence test scores, reading test scores, and chronological ages of the two groups. Table 7 summarizes the results of this preliminary investigation.

Table 7

Intelligence Test Scores, Reading Test Scores, and Chronological Ages of Subjects in Familiarity-Neutrality Study

	Groups	
	Advance Organizer Only (N=41)	Control Introduction Only (N=29)
Mean I.Q. ^a	64.12	63.28
S. D.	7.89	8.83
Range	49-89	43-86
Mean Rdg. Ach. ^b	3.63	3.29
S. D.	.84	.86
Range	2.3-5.0	1.8-5.0
Mean C.A. (months)	176.46	182.07
S. D.	18.67	10.62
Range	148-179	154-218

^a Slosson Intelligence Test for Children and Adults

^b Gates Advanced Primary Reading Test

Several t tests (Hays, 1963, p. 311) were performed to determine if (a) the mean score of either group was significantly different from the expected chance score of 7.5 and if (b) the mean score for the advance organizer group was significantly different from the mean score of the control group. The analyses revealed the following:

1. A non-significant ($p > .05$) difference between the mean score of the organizer group and the expected chance score (t value of .89);
2. A non-significant ($p > .05$) difference between the mean score of the control group and the expected chance score (t value of 1.02);
3. A non-significant ($p > .05$) difference between the mean scores of the advance organizer and control passage groups (t value of .06).

In view of these results, the following can be stated:

1. The learning material was unfamiliar. Scores on the criterion test were not significantly different from scores that would have been made by chance alone.
2. Both introductory passages were neutral. Scores on the criterion test were not significantly raised by reading either the advance organizer or the control introduction (analyses 1 and 2 above).
3. The advance organizer and control introductions did not offer differential assistance in responding on the criterion test (analyses 3 above).

These empirically-derived conclusions verified the previous assumption of the unfamiliarity of the learning material and the neutrality of the introductory passages.

APPENDIX F

INSTRUCTIONS TO PARTICIPATING TEACHERS

INSTRUCTIONS
To Teachers Participating in Organizer Study

Materials

You have been given four (4) different kinds of printed materials:

1. One kind of "introductory passage" (yellow cover)
2. Another type "introductory passage" (yellow cover)
3. A "learning passage" (blue cover)
4. An "achievement test" (white mimeograph)

The introductory passages (materials no. 1 and 2) are contained in the large brown envelope included in the set of materials given to you.

Procedure

The study is to extend through four (4) days, Monday through Thursday.

Please execute the following procedures precisely as indicated. Uniform adherence to these procedures by all participating teachers is a necessity.

Monday - Distribute the "introductory materials" to the students (their names are on these materials). You will notice that half the students in your room have one kind of introductory passage, while the other half of the students have a second kind of introductory passage.

Allow Twenty Minutes for the students to read and study the material.

You may help students individually at their seats with vocabulary, reading problems, etc.

Collect the materials; keep them out of sight. DO NOT ENCOURAGE OR EVEN PERMIT FURTHER DISCUSSION OF THE TOPIC PRESENTED IN THESE INTRODUCTORY PASSAGES.

Tuesday - Repeat Monday's procedure, however, this time allow only ten (10) minutes.

Wednesday - again distribute the introductory materials; give your students five (5) minutes to read them again.

Then distribute the "Learning Passage" to all students. Allow them to read and study this until the end of the period (a 40 or 45 minute period).

Thursday - repeat Wednesday's procedures exactly. Hopefully, all students will by this time have read the introductory material for four days and the learning passage for two day.

Then, on the same day (next period, or later in the day), distribute the achievement test to all students. Give them a full period to respond. After going over the test directions with them, give them no further assistance.

Collect all materials, have them ready for return to the investigator.

Caution

1. Impress your students with the importance of being present every day during this study. Even absence during one day will disqualify a student from inclusion in the study.

2. Do not inform the student that this is an "experiment"; rather, that this is another regular learning experience uni..

3. Do Not discuss, amplify, or in any way draw attention to the topic. Anything the students learn about the topic must come directly from their reading of the material and NOT from your explanations, help, or from conversations with other students, etc. This is extremely important.

4. Under no circumstances should children who have been given one kind of introductory passage be permitted to examine the alternate introductory passage. Differential exposure to the introductory passage is the crucial variable in this study.

Summary of Treatment Schedule

<u>Monday</u>	Introductory passages (20 minutes)
<u>Tuesday</u>	Introductory passages (10 minutes)
<u>Wednesday</u>	Introductory passages (5-10 minutes) <u>Then</u> , Learning passages (rest of period)

Thursday

Introductory passages (5-10 minutes)

Then, Learning passages (rest of period)

*Then, Achievement test (one regular period)

* If the test cannot be given this day, give it on Friday.

APPENDIX G

SUMMARY OF FACTORS REDUCING SAMPLE SIZE

The table and subsequent text describe in detail the various factors operating to reduce the final sample size.

Table 8

	NORMAL			EMR		
	Remain- ing N	Organizer	Control	Remain- ing N	Organizer	Control
Total <u>Ss</u> Initially Available	260			395		
Less <u>Ss</u> with inadequate Rdg. Ach.	257			259		
Less <u>Ss</u> with chronic absences	250			239		
Total <u>Ss</u> entering study (Day 1)	250	135	114	239	124	115
Total <u>Ss</u> taking initial test (Day 4)	229	126	103	215	114	101
Total <u>Ss</u> taking delayed test (Day 18)	195	103	92	207	110	97
Less <u>Ss</u> randomly dropped to equate N's	184	92	92	184	92	92

Of the 395 educable students available for the study, approximately 34 per cent were excluded because of reading deficiency while about 5 per cent were excluded due to their record of chronic absences. The number of EMR Ss eligible for participation, then, was reduced from 395 to 239.

With the same exclusion criteria applied to the Newark normal subject pool, 1 per cent of the Ss were dropped for inadequate reading and 2 per cent for chronic absences. This resulted in 250 eligible intellectually normal children.

The remaining 239 EMR students, then, entered into the main study. Using the split-plot technique, qualified students in each class were randomly assigned to the advance organizer or the control introduction group; this resulted in 20 experimental and 20 control groups. The total number of subjects in the organizer group was 124 while 115 were assigned to control groups.

In similar fashion, the remaining 250 normal students were

assigned to 11 organizers and 11 control groups with a total organizer N of 135 and control N of 114.

After studying the appropriate introduction and subsequent learning passage, the students then responded to the achievement test. Scores on this test constituted the measure of initial retention. Not all students, however, were available or qualified for this initial testing. Because the treatment schedule required four consecutive days of participation and because some students were not present for the test, the sample size at the time of testing (Day 4) was reduced to 215 EMR and 229 normal Ss.

Between test 1 (Day 4) and test 2 (Days 16, 17 or 18), some additional attrition occurred. Specifically, 34 normals were not available for delayed retention testing while only 8 EMR students were absent. Only the scores of Ss who responded to both tests were included in the final analyses. This procedure eliminated possible sample bias due to selective attrition between the first and second testings.

Finally, to simplify subsequent statistical analyses, 34 Ss (23 EMR and 11 normal) were dropped to equate all n's.

Table 3 summarizes descriptive data for all Ss who participated in both administrations of the test.

APPENDIX H
INTERACTION PROFILES

Figure 1

F test on mean number of correct responses between two treatment levels (organizer and control) on Learning and Retention.

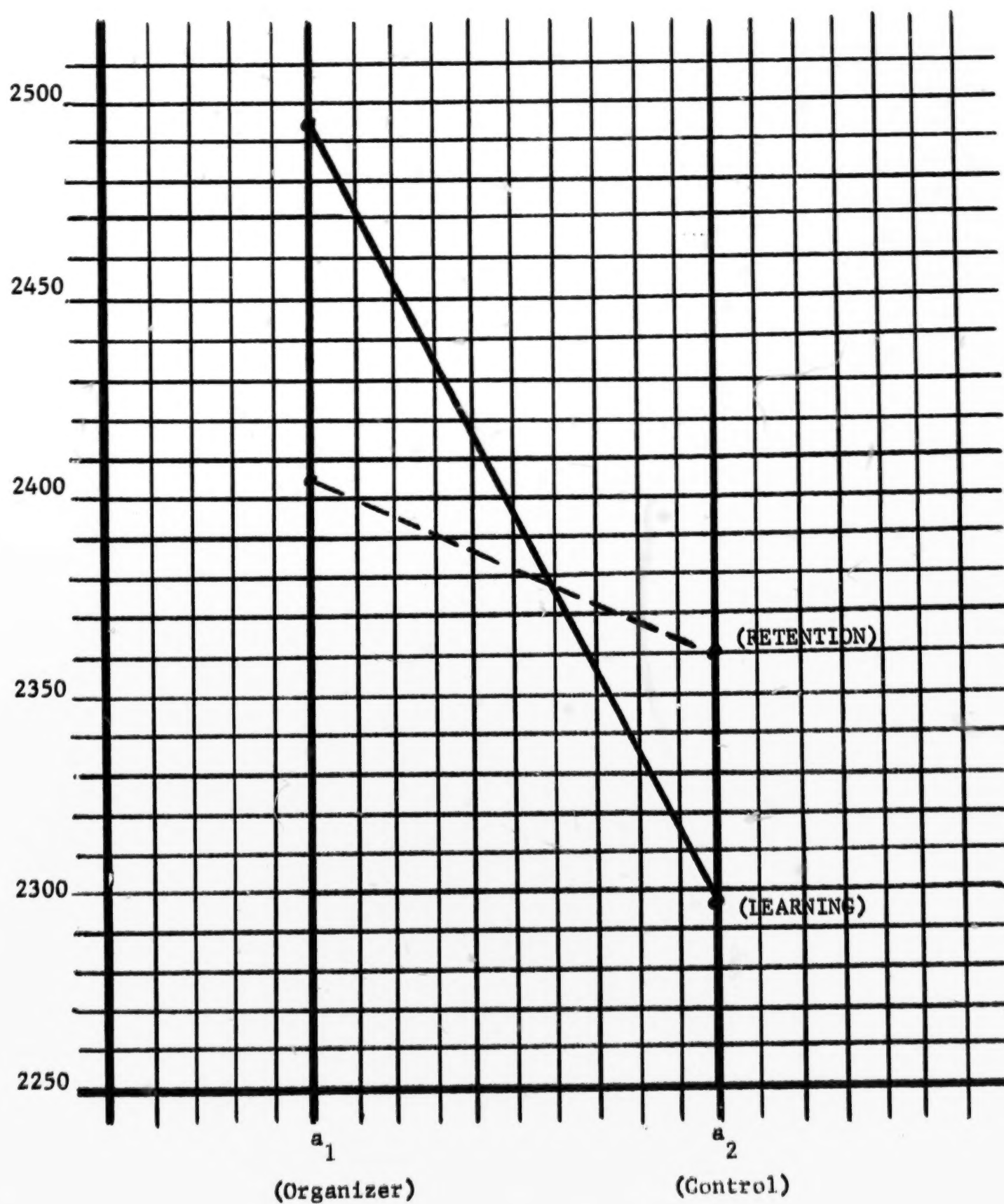


Figure 2

F test on mean number correct responses between two levels of treatment (organizer and control) and the normal and EMR status levels.

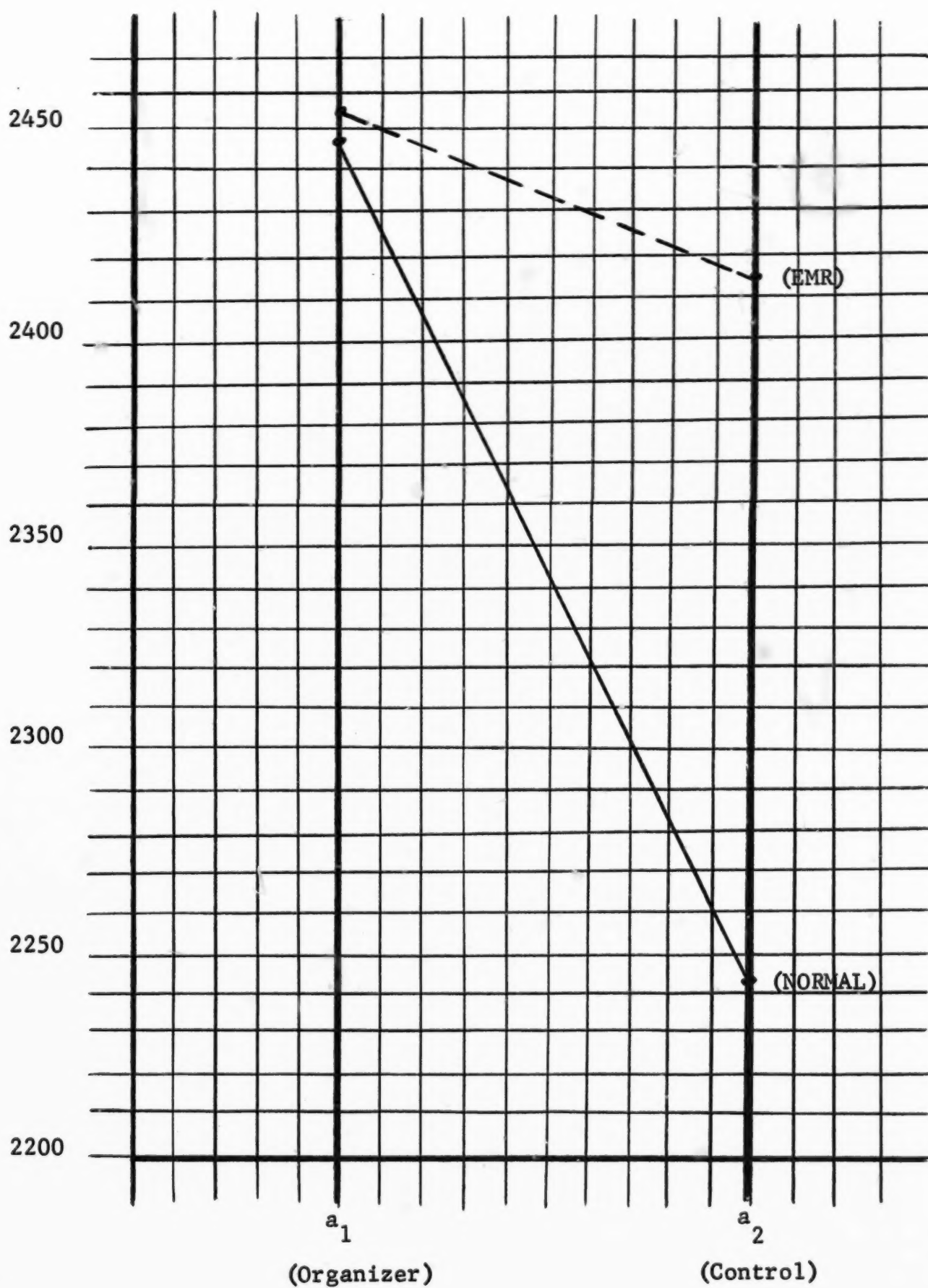
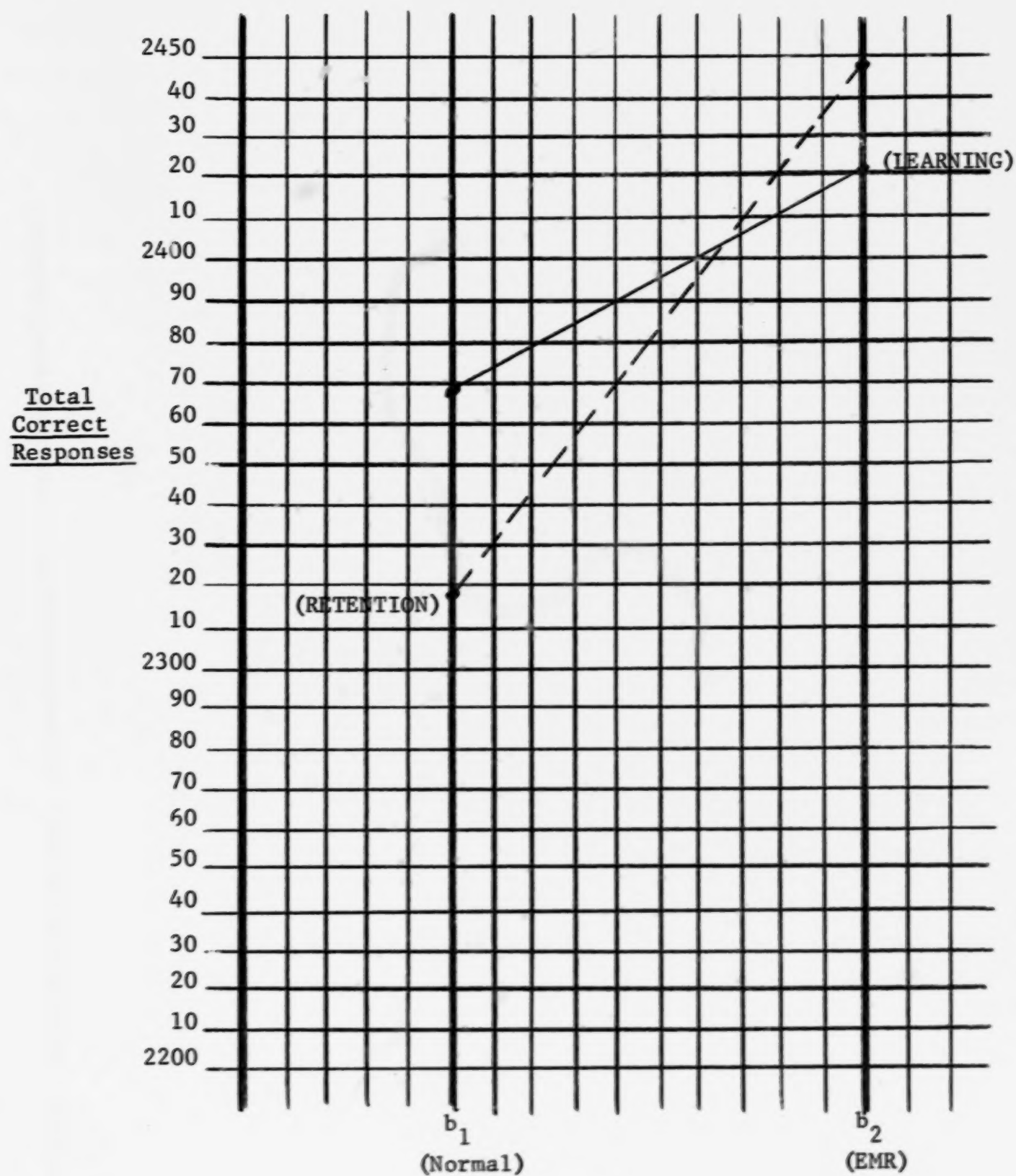


Figure 3

F test on mean number of correct responses between two treatment levels (normal and EMR) on Learning and Retention.



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Learning Subject Matter Concepts from Prose:
Studies of the Independent and Dependent Variables

Research within the theoretic framework of Subsumption Learning Theory (Ausubel, 1963) is research on the influence of the structure of written expository passages on the learning of meaningful verbal concepts. Empirical research on the learning and retention of meaningful subject matter concepts requires first, operational criteria for determining when meaningful subject matter concepts have been learned and second, techniques for analyzing written composition in terms which are theoretically and empirically related to the criterion measures.

Although a fairly extensive literature on concept learning exists within the field of experimental psychology, that research has been conducted almost exclusively with materials which would not be classified as school subject matter. While the rather few studies which have been conducted with school subject matters (such as those by Ausubel and his colleagues) have involved the use of appropriate materials and tasks, they have been conducted almost entirely without regard for the need to operationalize the independent variables (the nature of the expository passages) and the dependent variables (criterion tests of concept acquisition) in their research.

The present set of studies represents an initial attempt to carefully specify (that is, to operationally define) the dependent variables to be used in studying the learning of subject matter concepts, and to establish some technique for describing or analyzing the order or sequence of concepts as they occur in written exposition. Further, some attempt was made to determine the relationships between different sequences in written composition and success on the operational criteria for concept learning.

This research was viewed as necessary since the results of research with advance organizers, while generally interesting because of the success of organizers, has not actually resulted in extensive research, nor have educators begun to develop written curriculum materials from the theory. The failure of researchers and educators to make full use of the findings of research on Subsumption Learning Theory can largely be attributed to the fact that Subsumption Theory contains few attempts to operationally specify the characteristics of advance organizers. The research presented here makes a first step in that direction.

The plan in the present research was first, to examine the item forms appropriate for assessing the attainment of subject

matter concepts, second, to study the relationships among those item forms, and third, to determine the effect of the composition of written instruction on the attainment of subject matter concepts.

Experiment I

An examination of the experimental literature on concept learning reveals that research workers operationally define concepts in two ways: as operations of classification or categorization, and as statements of hypothesis or definition (Bourne, 1966). While both operations are used in experiments on concept learning, it is fair to say that the majority of those researchers doing work in this area rely on the classification or categorization task as the criterion operation.

Despite some criticism of the paradigm and materials widely employed in concept formation research (Carroll, 1964), generalizations regarding human conceptual behavior are frequently based on experiments in which concept learning is defined as correct classification of a series of geometric shapes or figural patterns. Few, if any, attempts have been made to establish a continuity between such experimental studies of concept learning where the criterion task is classification, and the learning of subject matter concepts where the criterion task is rarely, if ever, classification.

Further, no systematic attempt has been made to demonstrate that the relationship between classification and definition warrants the inference that these tasks are equivalent measures of some unitary capability which is acquired when complex subject matter concepts are learned. This, in spite of the fact that most psychologists apparently accept the notion that people can learn to classify without being able to verbally express a classifying rule (Deese, 1967).

The present study was designed to yield data bearing on several issues. First, are classifying, defining and generating novel exemplars equivalent tasks in the sense that each is a behavioral concomitant of the psychological construct "concept"? Second, is there a contingent relationship among these indices of concept attainment? Third, do these widely used experimental tasks serve as appropriate paradigms for developing item forms (types) when testing for attainment of complex subject matter concepts? Fourth, does the sequence in which these item forms are encountered during testing influence achievement?

Method

Subjects. Forty-two students in an undergraduate educational psychology class served as subjects (Ss) for the research.

Procedure. As a part of their regular classwork Ss were given a list of terms representing concepts commonly taught in that section of the course on the psychology of learning. Ss were informed that they would be tested to determine whether or not they had learned the concepts and that their task was to learn these concepts through reading one of the books which was being used as a text (The Conditions of Learning by R. M. Gagne).

To promote concept learning in the experimental sense, all Ss were told that the testing procedure would involve the classification of conceptual instances, and that they should attempt to learn the concepts in such a fashion that they could succeed on the classification task. Ss were not told that they would be required to define and give novel exemplars since it is generally accepted that Ss could assure achievement on these two tasks through rote learning. Rote performance on one or two of these tasks would necessarily alter the relationships under investigation.

From the set of concepts identified for the Ss, a subset of 18 concepts were selected for testing. A two part examination was constructed using this subset of concepts as a basis for developing items. Part I of the examination was constructed by generating five positive instances for each of the 18 concepts. All of the instances were represented as descriptions in the English language. The task for the Ss on this portion of the examination was to classify each of the instances (descriptions) as one of the 18 concepts by applying the appropriate category label. Part II of the examination consisted of two questions for each of the 18 concepts. One question requested the Ss to specify the attributes of the category represented by the concept label (i.e., to define the concept). A second question required that, in addition to defining each concept, Ss generate a novel instance of the concept ("novel" in this case was defined as an instance to which Ss had not previously been exposed in the textbook). A comparative illustration of the three item forms used in developing the test follows:

Item forms for concept "Motor Chain Learning"

Classifying: "Cross out letter C on your answer sheet if the given example is "motor chain learning."
Example: "Learning to do a summersault"

Defining: "Write a definition of the term: motor chain learning."

Generating Example: "State or describe a novel example of the term: motor chain learning." (novel means an example not given in the text.)

Separate booklets were constructed for the two parts of the examination.

On the day of the examination Ss were randomly divided into two groups, each containing 22 Ss. Group I Ss performed on the classification task first. Group II Ss performed on the definition and generation of novel examples task first. After each S had completed performance on the first assigned task, he then went on to the remaining task. Thus, the two groups differed only with respect to the sequence in which they performed the tasks.

The two parts of the examination were scored independently. The classification portion of the examination was scored objectively. A criterion of one incorrect classification was established and performance on each concept for each subject was scored as successful or unsuccessful. In scoring Ss performance no distinction was made between errors of inclusion and errors of exclusion although both types of errors in classification are possible.

Performance on the defining task was scored independently from the generating novel examples task. Performance on each of these tasks was scored as successful or unsuccessful by three independent judges.

From the original 18 concepts which were included in the test, four were selected for the present analysis. The determination of which four were to be used was made on the basis of the confidence held by the three judges as to their competence in regard to judging the concepts. That is, the four concepts which were chosen were believed by the judges to be the ones which they would be best able to judge. The concepts which were analyzed in the present study were (from Gagne) "stimulus response learning," "motor chaining," "extinction," and "generalization."

Results

The results with respect to the relationships among performance on the various item forms are reported in Table 1.

Table 1
Relationships Among Item Forms

	Correlation (Phi)	
	Group I	Group II
Classifying-Defining	.02	.06
Classifying-Generating Example	.11	.10
Defining-Generating Example	.04	.37*

* $p < .001$

As can be seen, the only significant correlation obtained was that between defining and generating examples for Group II ($X^2 = 11.4$, $df = 1$, $p < .001$). None of the other relationships approaches statistical significance.

The results with respect to the relative success of the two groups is shown in Table 2.

Table 2
Comparison of Group Success on Item Forms

	Number of Concepts Correct ¹		
	Group I	Group II	X^2
Classifying	54	56	2.1
Defining	64	50	14.9*
Generating Examples	68	56	13.5*

* $p < .001$

¹ Total possible correct = 88

Group I performance was significantly different from Group II performance in defining ($X^2 = 14.9$, $df = 1$, $p < .001$) and in generating examples ($X^2 = 13.5$, $df = 1$, $p < .001$). The two groups did not differ on the classifying task ($X^2 = 2.1$, $df = 1$, $p > .10$).

The relative difficulty for each item form for each group was determined by means of a X^2 statistic (McNemar, 1962). This set of tests compared the differences among the three possible pairs of totals for each item form found within each column in Table 2. The X^2 value for each comparison was non-significant in every case except that between classifying and generating examples for Group I ($X^2 = 6.5$, $df = 1$, $p < .02$). It is worth noting here that the same comparison for Group II yields a X^2 value equal to zero (the totals for classifying and generating examples for Group II are the same).

Discussion

Probably the most noteworthy finding of the present study was that performance on the three item forms is essentially unrelated. This outcome is especially relevant for anyone attempting to construct an instrument to measure learning of subject matter concepts, since performance on one item form alone would not permit an inference regarding performance on the other item forms (i.e., if one can define a concept this provides little or no information about his classifying capability). The results, then, suggest it would be inappropriate to treat these criterion tasks as simply equivalent measures of a unitary capability which is acquired when a complex subject matter concept is learned.

The significant correlation between the item forms for defining and generating examples suggests that the capability underlying performance on these two item forms is similar. Such a finding is intuitively reasonable, since a concept definition which is understood ought to act as a generating device for producing novel yet appropriate examples of that concept in much the same manner as grammatical rules act as generating devices for producing novel yet appropriate sentences. Again, however, the correlation between performance on these item forms is low, and no clear conclusion regarding the extent of similarity can be drawn.

The evidence is clear that the sequence in which different item forms are encountered during testing differentially affects performance. Classifying, even without explicit feedback as to correctness, facilitated performance on both defining and generating novel examples. It might be that subjects learn during the classifying task by selecting a particular instance which they are certain is an exemplar and use this as a criterion against which to match subsequent examples. In this way Ss can provide themselves with feedback regarding the correctness or incorrectness of other examples.

The improvement of Ss on the generating examples task by subjects who have already classified is not surprising. Subjects can easily pick an exemplar during the classification task of which

they are quite certain and during the generation portion of the examination make simple substitutions for the content terms of that example (e.g., "learning to do a somersault" becomes "learning to do a handstand"). In so doing they create an example which is, and must be judged as novel, but in some sense is only an example of their linguistic competence rather than evidence that a concept has been learned.

The equivalent performance of both groups on the classifying task suggest that this item form is less influenced by performance on adjacent item forms. Such a result supports the notion that more extensive use of this type of item might be made when tests of concept attainment in school subject matter are developed. Performance on the classification item form is subject neither to the effects of sequence nor to the possibility of retention as are both defining and generating novel examples.

All three item forms appear to be of equal difficulty if the effect of sequence is not a factor. One could use any item form to test for concept attainment and expect approximately the same likelihood of determining that the concept had been learned. While these item forms appear to be equivalent in terms of difficulty, however, it is well to mention again that they are not overlapping with respect to what is being tested.

In some sense the distinction between classifying on the one hand and defining and giving novel examples on the other hand is like the distinction usually made between recognition and recall as measures of retention. The difference, however, is clear. Recall and recognition demand of the individual that he recognize or recall an event to which he has been previously exposed. In the present study (and others like it) what the subject is recognizing in the classification task, and what he is recalling in the other tasks, is not simply an event to which he has been previously exposed. Performance on all three item forms is productive rather than reproductive.

Experiment II

The purpose of this experiment was to determine whether deliberate alterations in the structure of written expository passages designed to teach a specific subject matter concept would differentially influence performance on the defining, classifying and generating novel example item forms. Several analyses suggest that written passages designed to teach a specific subject matter concept consists of a definition of the concept, examples of the concept, or a combination of these two, and that the inclusion or ordering of these elements is related to learning (Evans, Glaser & Homme, 1962; Bureau of Research, Cooperative Research Monograph No. 15, OE 12019, 1966.)

Since in Experiment I performance on each of the item forms for concept learning was shown to be largely independent from other item forms, it was expected that altering the content of written composition with respect to the inclusion of definitions and examples would result in reliable differences in performance on the various item forms. It was anticipated that written exposition including definitional statements would result in better performance on the definition item form, subjects learning concepts from passages including a number of examples of that concept might perform better on the classifying item form, and subjects learning concepts from written exposition containing both definitional statements and examples might perform better on both item forms. No basis exists for predicting the effect of passage composition on the novel example item form.

Method

Subjects. Fifty-four students in an undergraduate educational psychology class served as subjects (Ss) in this experiment. The Ss participated in groups.

Procedure. The concepts to be learned in the present study were drawn from the subject matter of anthropology. In particular, a set of three kinship concepts was to be learned by each subject. The kinship concepts were chosen because a rather careful and extensive analysis of these concepts has been accomplished by anthropologists and this analysis provided for explicit definitional statements of the concepts. The kinship concepts to be learned were lineals, co-lineals and ablineals.

A set of instructional materials was developed for use by each subject. These materials included first, an instructional booklet designed to teach the three designated concepts; second, a chart or diagram of a kinship group; and third, a test on the three concepts which consisted of the classifying, defining, and generating novel example item forms.

The kinship chart and the tests were the same for all treatment groups. Three different types of instructional booklets were developed and served as the basis for the three different treatments. All instructional booklets began with a three page introduction to kinship groups which included general statements about the relative positions of members of a family, bloodlines, and a small diagram which included the symbols used to designate males, females, blood, and marriage relationships within a kinship group. The last three pages of the booklet differed for the three treatment groups. One concept was presented on each of the three pages. It was in the presentation of each of these three concepts that the structure of the task differed. Group I Ss were instructed

on each concept by simply presenting them four examples of the concept. These examples were chosen from the diagram of the kinship group which was given to each S (Part 2 of the materials). For example, Ss in Group I (Examples only) were to learn the concept lineals from the simple two-sentence statement, "Some examples of lineals from Cliff Gibbs' viewpoint are William Gibbs and Margy Hunter. His lineals are also Oscar Brown and Chris Gibbs." Group II (definitions and examples) Ss were given an instructional booklet which contained the same three introductory pages and three instructional pages which differed. Ss in this group were to learn each of the three concepts from an instructional page which contained not only the examples of the concepts, but also a definitional statement of the concepts. Thus, the subjects in this group were to learn the concept lineals from an instructional page which contained the following statements: "Lineals are all males and all females from whom EGO is descended who consider EGO as an ancestor. Examples of lineals from Cliff Gibbs' viewpoint are William Gibbs and Margy Hunter. His lineals also are Oscar Brown and Chris Gibbs." These subjects as the subjects in Group I, were to use the diagram of a kinship group to identify the examples specified on the instructional page. Group III (definition and discussion) Ss were given instructional booklets containing the same three introductory pages and three instructional pages which differed from the other two groups in that a concept was to be learned from a definitional statement and an elaboration of that definitional statement. That is, subjects in these groups were to learn the concept lineals from the following paragraph: "Lineals are all males and females from whom EGO is descended or whom consider EGO as an ancestor. If you were the EGO, any person from whom you are directly descended (your ancestor) would be a lineal to you. Any anyone who is directly descended from you would also be your lineal. Lineals are so classified because of their position relative to you, not because of sex; therefore, lineals are considered on both father's and mother's sides."

It probably should be noted at this point that the structure of learning materials for Ss in Group III most closely resembles that recommended by Ausubel. Very little attempt is made to provide empirical props, and each paragraph is structured so that it begins with a general definition of the concept and proceeds to specifically elaborate on that general statement.

Since there might have been an order effect which would interact with a particular instructional mode, the order in which concepts were presented was counterbalanced within groups and across treatment groups.

The test given to all Ss consisted of three parts. The first part was a classification task where each concept was tested by having Ss indicate whether or not a particular individual could be categorized

as lineal, ablinal, or co-lineal. The second part was a definition test where a set of seven alternative definitions were to be matched with the three concepts. Four of the alternatives were distracters. The definitional statements contained in the test were not identical in a formal sense to those presented in the instructional materials, but were substantively the same. The third part of the test required Ss to generate a novel example of each of the concepts by having him outline the structure of a kinship group using his own family and then identifying each of the concepts which he was to have learned within the kinship diagram that he had created.

The Ss were randomly assigned to one of the three treatment groups so that 18 Ss participated in each treatment group. All Ss participated at the same time. The instructional materials were distributed to the Ss and all Ss were allowed 15 minutes to study the three concepts. Following the 15 minute study period Ss were required to perform on the test. All Ss completed the test within 15 minutes.

Performance on each of the three parts of the test was scored independently. Scores ranging from 0 to 10 according to the number of correct classifications were given for performance on the first portion of the test. Each concept was scored separately. Scores of 1 or 0 were given for each concept on the definitional portion of the test. Scores from 1 to 5 were given on the generating novel example portion of the test.

Results

The results on the classification portion of the test are summarized in Table 1.

Table 1

Mean Number Correct Classifications^a

		Concept			
		1	2	3	
<u>Treat-</u> <u>ment</u> <u>Group</u>	Example only	7.5	6.6	6.7	6.9
	Definition & Example	7.4	5.8	6.9	6.7
	Definition & Discussion	7.4	5.6	5.2	6.1
		7.5	6.0	6.3	

^aPossible number correct = 10

The extent to which the mean scores obtained on the classification items reveal significant effects of the treatment variables can be determined by examining Table 2 (Analysis of Variance Table for Classification Scores).

Table 2
Analysis of Variance Table
For Classification Scores

Source of Variation	df	MS	F
<u>Between Subjects</u>	53		
A (Type of passage)	2	11.04	2.19
Ss within groups	51	5.03	
<u>Within Subjects</u>	108		
B (Concepts)	2	32.60	12.20
AB (Type of passage x concepts)	4	4.76 2.67	1.78
B x (Ss within groups)	102		

As can be seen in Table 2 the mean differences obtained from the effects of the type of instructional passage were not reliable ($F = 2.19$, $df = 2, 51$, $p > .05$). Altering the composition of the instructional passage with respect to definitional statements and examples did not yield a statistically significant difference among the different groups. Further, the type of instructional passage did not interact with the particular concept being learned ($F = 1.78$, $df = 4, 102$, $p > .05$).

The repeated measures analysis on the scores for each concept yielded a statistically reliable difference among the mean scores for the three concepts ($F = 12.20$, $df = 2, 102$, $p < .01$). The latter result indicates that the subjects performed better on the classification task for concept number 1 (lineals) than for the other two concepts.

The results with respect to performance on giving novel examples is summarized in Table 3.

Table 3
Mean Score on Novel Example^b

<u>Treatment Groups</u>	<u>Concepts</u>			
	1	2	3	
Example only	3.4	3.0	2.5	3.0
Definition & Example	3.4	3.2	2.8	3.1
Definition & Discussion	3.5	2.9	3.4	2.9
	3.4	3.1	2.6	

^bMaximum score possible = 5

The results with respect to this item form are consistent with those obtained on the classification item form. The statistical analysis of the differences among means on the novel example item form is given in Table 4.

Table 4
Analysis of Variance Table
For Novel Example Scores

Source of Variation	df	MS	F
<u>Between Subjects</u>	53		
A (Type of passage)	2	.60	--
<u>Ss within groups</u>	51	6.51	
<u>Within Subjects</u>	108		
B (Concepts)	2	10.30	18.39
AB	4	.24	.42
B x (Ss within groups	102	.56	

As with the classification performance the obtained differences among treatment groups for the type of instructional passage were not reliable ($F > 1.00$, $df = 2, 51$). The type of instructional passage did not differentially influence performance on the generating novel example task.

The repeated measures analysis of subject scores on generating novel examples for each of the three concepts revealed a statistically significant difference among concepts ($F = 18.39$, $df = 2, 102$, $p > .01$).

The results with respect to the number of correct definitions given by each treatment group are summarized in Table 5.

Table 5
Number of Correct Definitions Selected
By Each Treatment Group^c

<u>Treatment</u> <u>Group</u>	Concept		
	1	2	3
1	4	2	3
2	10	9	9
3	8	5	6
	22	16	18

^cMaximum score possible = 18.

Since the data on the definition items was scored as either correct or incorrect, performance scores on the definition task were subjected to chi square analysis. A goodness-to-fit analysis for the three treatment groups for all three concepts revealed chi squares which were not significant. No treatment group performed significantly better on the definition item form.

Discussion

The results are both conclusive and disappointing. Within the content of the particular subject matter selected, at least it made no difference on the criterion measures whether or not a written expository passage designed to teach a specific subject matter concept contained definitional statements, examples, or some combination of those two elements. Since the study is limited to three concepts from a particular subject matter, no general conclusion should be drawn; however, it remains that in the present study the inclusion or exclusion of either definitional statements or novel examples was not differentially related to performance on the item forms (i.e., classifying, defining, and generating novel examples).

Since the subject's performance indicated that learning of the concepts had to some degree occurred, and since performance did in no case approach maximum, there is no reason to think that the lack of differential effect was a function of the test. Only in performance on the definition item form did subjects do poorly. That particular finding is interesting since two-thirds of the subjects were actually given definitions as a part of their instructional materials and could have been expected to do particularly well on the subsequent definition task.

Perhaps the most general statement that might be made is that it is possible to analyze expository passages designed to teach subject matter concepts into definitional statements and example statements, but that no evidence exists to suggest a relationship between the type of statement and performance on tests of concept acquisition.

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INFLUENCES OF AN ADVANCE ORGANIZER ON THE VERBAL LEARNING

101

AND RETENTION OF EDUCABLE MENTAL RETARDATE

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(A Comparison of Educable Mentally Retarded and

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RETRIEVAL TERMS

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Advance organizer

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Verbal learning

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Educable Mentally Retarded

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IDENTIFIERS

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Subsumption Theory/Meaningful Verbal Learning

ABSTRACT

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The effect of an experimental introductory passage (advance organizer) on immediate and delayed retention of a reading assignment presented to intellectually normal and retarded children was assessed.

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Educable mentally retarded adolescents who were randomly assigned to read the advance organizer or control introduction next studied a learning passage and then responded to an achievement test. The same test was re-administered after two weeks to obtain a delayed retention measure. The same procedures and materials were employed with intellectually normal children whose reading achievement and mental ages were comparable to the EMR groups.

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*Several EMR characteristics and limitations of the materials were presented as perhaps accounting for the failure of the advance organizer with the retarded students.

Final Report Review
Project No. 6-2122
Grant No. OEG 1-6-06122-1570

Influences of Advance Organizer On the Verbal Learning and Retention of Educable Mental Retardates (A Comparison of Educable Mentally Retarded and Intellectually Normal Performances)

John T. Neisworth
Robert N. Smith
Stanley L. Deno

University of Delaware, August 31, 1968

This project represents a unique attempt to develop and test an instructional strategy for educating educable mentally retarded children. The strategy derives from Ausubel's Subsumption Theory of meaningful verbal learning. This theory is one of the few which have been developed to deal with school learning, and its application to the education of the educable mentally retarded is wholly appropriate. Indeed, the development of an instructional strategy based upon some clear and defensible theory represents a wholesome and needed direction in research on teaching the retarded. First, there is little research in this area -- of whatever ilk; Second, the few studies which have been done (and these are mostly concerned with the comparison of methods of reading, and infrequently arithmetic, at the elementary levels) have focused only upon differences in achievement as a function of instructional method. The studies give little attention to the rationale underlying the methods, or more importantly -- as has been done in the present study -- to how the method interacts with the unique characteristics of the learner.

The author's explication of the Subsumption Theory, and the rationale supporting its application to the education of the mentally retarded are quite good. In addition, the design and preparation of the materials appear well done, and the authors' programming guidelines for the construction of an advanced organizer represents a small contribution to the operationalization of the Theory. The statistical analyses are appropriate. There are, however, a few points, of a critical nature which need to be mentioned. They are, briefly, (1) the authors' description of the sample, (2) the Slosson Intelligence Test, (3) the 30 item criterion test, and (4) the absence of suggestions of directions for further investigation. These will be taken up in turn.

1. Description of the sample. The brief section on the selection of subjects (page 22) was especially troublesome in that the normals and retardates were from different cities -- and indeed in separate states. The most ideal arrangement would have been to draw both retardates and normals from the same community and same school building if possible (to effect some gross equivalence among groups in regard to socioeconomic characteristics and other background factors). I am certain that the authors were aware of the sampling problem but, perhaps because of administrative difficulties or perhaps because certain children were unavailable to them for research purposes, were unable to secure populations which on the surface at least would have appeared to have been comparable. The fact of the matter is that it is not possible from a description of the sample given in the report to know what the characteristics of the samples or of the communities were. Given the unique circumstances of the study in regard to the selection of samples, additional

information on the communities (were they at least grossly comparable?) and children should have been reported.

2. The Slosson Intelligence Test. (SIT). It is presumed that both normals and retardates were administered the Slosson Intelligence Test during approximately the same time period (if this is the case the authors should have made this explicit in the report). The equating of the groups prior to actual study -- if it did in fact occur -- represents a strength of the study. Too often comparative investigations of normals and retardates involve tests given at different times for normal and retarded groups, and thus the populations are not comparable on a dimension typically fundamental to the study.

The problem here, however, involves the SIT. As of a few years ago there was little information on the validity of this test for use with school-age non-institutionalized retarded children. Its meaning as related to the present population then would seem questionable. The authors should have presented information on the time and circumstances of administration of the test, and more importantly, data on the test's validity, reliability, and appropriateness for the groups under study.

3. The criterion test. All analyses of learning and retention rely upon the 30 item final test. This test has one essay question, seven matching items and 22 multiple choice items. Because it is critical to the findings, the content and construction of this instrument bear especially close scrutiny. First, the authors indicated that four options comprised the multiple choice test (p.19), but if the test reproduced on pages 54-58 is accurate, there are only three options. Hopefully, this is only a typographical error.

The item content ranges from simple factual recall through translation and extrapolation. The latter kinds of items measure the higher order educational objectives, and thus involve some cognitive sophistication. The test items thus were not homogenous in regard to content. With normal subjects this should not pose a problem but one might suspect that retardates would be penalized by the test items measuring higher order cognitive functioning. Given equal learning by retardates and normals, the normals might perform better on the test only because the structure of the test items favored a good performance by them. The way to avoid this kind of problem is to carefully balance criterion questions in regard to the kind of objective being measured and to use each of these components as criterion measures. Thus, there could be a block of test items measuring pure factual recall, a block measuring the subjects' ability to translate, to extrapolate, etc. It may well be, as has been demonstrated in other studies, that retardates may perform as well as normals where simple learning was concerned, but have difficulties with complex materials. By not being as careful in the construction of the criterion instrument as was the case in other aspects of the study, a confounding may have occurred in which the retardate criterion scores were differentially affected by the test content. If this is the case, the validity of the subsumption theory in instruction of the mentally retarded has not yet been rejected as has been indicated by the results of the present study. The last item of the criterion test is essay, and we are told that objective standards were applied to the scoring of this question. It is important (and should have been noted,) whether or not the scorers were aware of the group to which the respondent

belonged (i.e., normal or retarded) so as to avoid any bias in the scoring of this question. In addition, the scoring standards and weights given to all questions should have been presented by the investigators somewhere in the final report. In this way the materials and procedures are made public, and those wishing to question, revise, or replicate the instrument have the materials available to do so. Finally, the test's reliability should have been reported.

4. Authors' suggestions for further investigation. The problems enumerated above certainly do not add up to a rejection of this report. It is suspected that most of the points made (the criterion problem excepted) reflect certain lapses in reporting -- a finding not atypical of many research project writeups. Overall, the project was well conceived and executed.

The major finding is that contrasted with normals, and contrary to the prediction, the educable mentally retarded subjects tended not to benefit from advanced organizers. In view of this result the authors would seem to have some obligation to suggest directions for future research. Would they suggest that this line of investigation be abandoned altogether? That modifications in method be made to take account of problems encountered in the present study? The authors are in a particularly strategic position to advise us on where to go from here, but they are remarkably silent in this regard. Additional material, perhaps in the form of a very short addendum, which would spell out directions for further study in the light of the authors' experiences in this project would seem appropriate.

Finally, a personal note. This reviewer would not abandon research in this area although the results of this one study proved disappointing. Next steps, of modest scale, might involve explorations of ways of structuring and presenting organizers to retardates to facilitate their subsequent learning. It should be noted that this strategy need not involve comparisons with normals, for as Baumeister has noted, the study of normals will not tell us what to do for retardates. Any findings deriving from comparative studies of normals and retardates, as was done here, must ultimately be put to the test with retardates.